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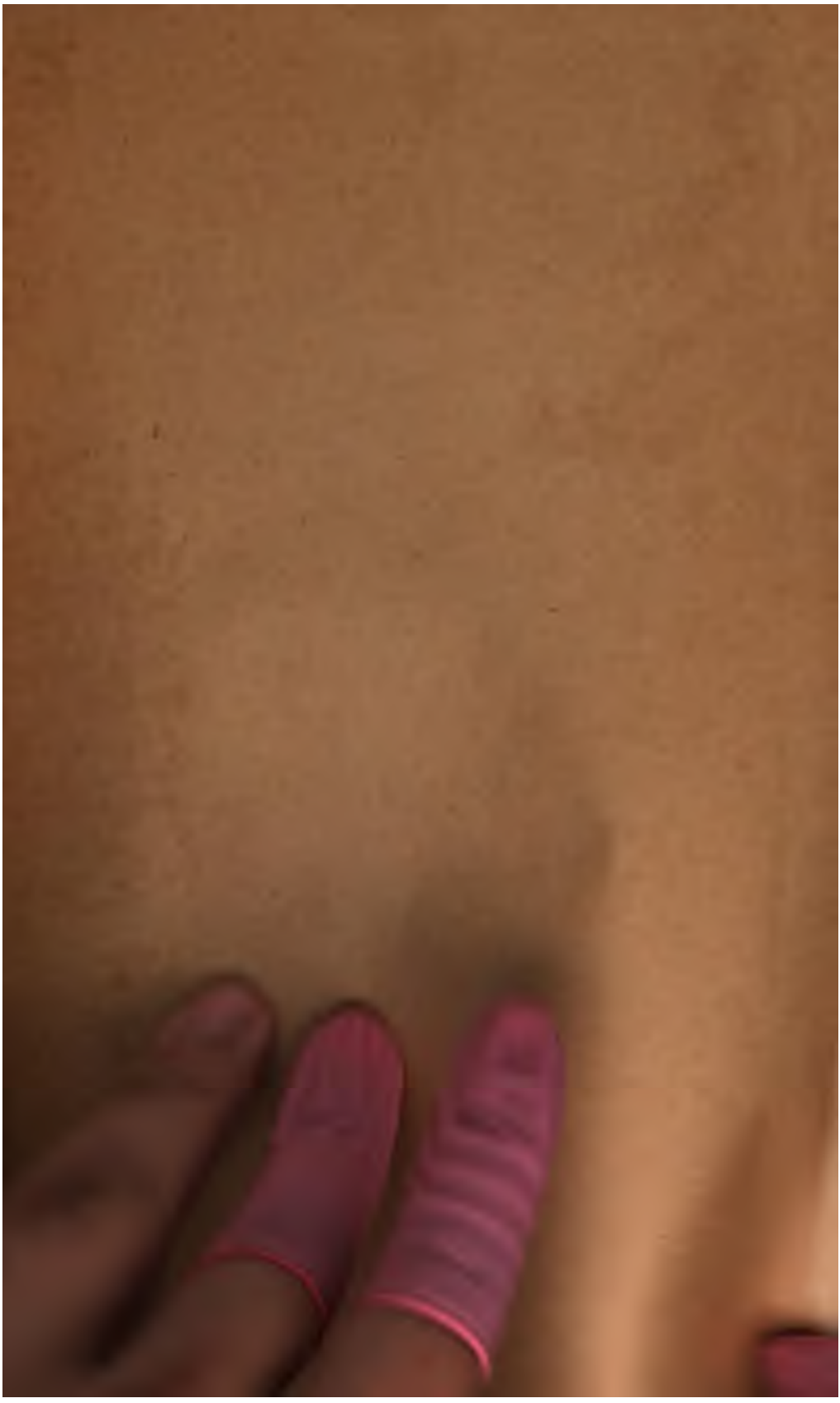

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THE MONIST

ERNST HEINRICH HAECKEL.

AN APPRECIATION.

THE overwhelming disaster which has befallen Germany seems to have drawn into its vortex many of her leading thinkers. At least their death is a sad coincidence. Foremost among the recent victims of the grim reaper are her three preeminent scientists, Paul Ehrlich, Emil Fischer, and Ernst Haeckel. Ehrlich was universally recognized as the world's foremost therapeutist, and Fischer is lauded by Professor Harrow of Columbia University "as the greatest organic chemist of all times," but undoubtedly the most popular and widely known of the three was Haeckel, the "sage of Jena," who died on the 8th of August in his 86th year. Of him alone can it be said that he had reaped the full fruition of his life and labors. He no longer was a merely national figure, his writings had been translated into the languages of all civilized races and were sold in hundreds of thousands of copies. His influence upon the most advanced thinkers of our own country has been such as to challenge inquiry. But the wealth of ideas with which he enriched the world is so overwhelming that it is impossible, even approximately, to do him justice in a short sketch.

I met him for the last time in the summer of 1905, while visiting the Jena Zoological Institute, his own magnificent creation, situated in one of the most charming suburbs of the quaint university town, in the midst of stately trees and

dominated by majestic silence. In spite of his years he had remained erect and elastic, reminding me of his athletic stunts on the horizontal bar and his diving feats in the ocean; even his somewhat high-pitched voice still sounded remarkably young. Much lecturing had not entirely removed the peculiarities of his Potsdam local dialect. Moreover, Professor Haeckel had never cultivated the widely practised academic habit of inspiring youthful listeners by means of skilfully and diplomatically developed sentences. He always spoke to the point, he chatted—to the point, but was never dull.

And as was his personality so was his environment. The Zoological Institute is a faithful expression of the artistic side of his nature. In the large entrance-hall six prominent tablets meet our eyes announcing in lapidary style the names of Aristotle, Linnæus, Lamarck, Cuvier, Johannes Müller, and Darwin: the confession of faith of the *genius loci.* Darwin's plastic head, laurel-crowned, adorns the library together with a similar memento of his great apostle: Haeckel's marble bust executed by the sculptor Kopf in Rome. All the walls of the great staircase are veritably alive with pictures, copies of his unique aquarelles representing the fruits of his travels: tropical landscapes, gruesome gigantic skeletons, and, by way of contrast, the wonders of his beloved sea-fauna, the unicellular microscopic organisms known scientifically as Radiolaria and Rhizopoda and distinguished for their calcareous and siliceous skeletons of endless variety and wondrous delicacy. Thousands of these were discovered and collected by the great naturalist himself, particularly in the Southern seas. The symmetrical arrangement and composition of the thousand and one miniature parts of these skeletal scaffoldings represent most phantastic asteroid groups and suggest many new motives to the decorative artist. The Institute itself has already carried out some of these sug-

gestions by decorating its plafonds with beautifully colored designs of siphonophores, those polymorphous colony-forming groups of oceanic hydrozoans which are a constant delight to the beholder.

The most splendid results of Haeckel's investigations are, however, found in the Zoological Museum where even the layman may learn something about the evolutionary theory. A gigantic model of the gastrula larva, the earliest embryological stage common to all multicellular animals, arouses at once our attention and bids us to observe further the genealogically arranged groups of animals and their transitional forms, especially the Australian duckbill, porcupine ant-eaters, and lungfish, which occupy significant positions as connecting links in the genealogical exhibitions of the Museum. But the most important material for the demonstration of the fundamental principles of embryology, one of which—the biogenetic law—Haeckel has condensed in the well-known formula "Ontogenesis is the recapitulation of Phylogenesis," is contained in thousands of microscopic slides. These vast and valuable scientific treasures of the Institute were gathered and constantly enlarged by Professor Haeckel on his extended journeys through India, Algiers, Madeira, Ceylon, Portugal, Italy, and wherever the opportunity for rich finds offered itself. Surely, under such a teacher and in such an environment study becomes a delight, and many brilliant and ambitious young men, litterateurs like the Hauptmanns and Wilhelm Boelsche, philosophers, theologians, medical and biological students —among them the foremost biologists of to-day—gathered in the quiet Tusculum of the Zoological Institute to receive inspirations which lasted a lifetime.

Out of this unique and resplendent frame the image of the great naturalist shines forth with luminous clarity. Here Ernst Haeckel had found the central attraction of his life and activity, admired both for the results of his

research and the enthusiastic flight of his hypotheses. Darwinism with all that this term implies constitutes the chief source of his working methods and of his results. When in the year 1859, after long, quiet, and industrious labors, the hermit of Down in his modest way and almost under compulsion enunciated his views on the origin of species they found an almost immediate response, in the midst of a general frosty silence, in the enthusiastic endorsement from Jena.

Haeckel was twenty-six years of age when Darwin's epoch-making work appeared. As early as in his twelfth year he had shown a decided preference for the study of the natural sciences, but he obeyed the wish of his father, himself a practising physician, and studied medicine. In 1857, when only twenty-three years of age, he opened an office in Berlin. While pursuing his studies in Würzburg, Berlin, and Vienna, he had come under the influence of Kölliker, Virchow, and Johannes Müller, then the three most eminent authorities in their respective spheres of histology, anatomy, and physiology; they stimulated his unusually receptive mind to an extraordinary degree. The mere practice of medicine became, therefore, more and more distasteful to him, so that we are not surprised to find him as early as 1861 as *Privatdocent* at the University of Jena, long known as the most fertile breeding-place of new and forceful ideas, the bulwark of free research.

In the short space of another year he was advanced to the position of *Professor extraordinarius* on the basis of his brilliant monograph on the Radiolaria, the first important fruit of his youthful investigations. In this work he gives full expression to his admiration of the Darwinian theory, stressing it with strong emphasis because his German colleagues had received it with much disfavor. Darwin had desired that his results should be subjected to a thorough test and looked "with special confidence to young

aspiring naturalists who will be capable of judging both sides of the question impartially," adding that, "Whoever is inclined to the view that species are inconstant will perform a great service to science by scrupulously acknowledging this conviction; for, only in this way can the mountain of prejudice be removed under which it lies buried." Haeckel declared that he completely agreed with this view and felt impelled to proclaim his conviction of the transmutability of species and the genealogical relation of all organisms. However, he expressed himself very cautiously, declaring that he did not consider all the claims of Darwin proven, criticizing especially the failure of the great naturalist to discuss the origin of the primitive organisms from which all others were derived. Darwin, he said, could not, in order to be consistent, assume a special act of creation for these lowest forms. Yet he admired the first real scientific attempt to view all the phenomena of the organic world from a single uniform standpoint and to replace unintelligible miracle by an intelligible natural law. Unfortunately, this courageous confession of the youthful zoologist was known only to the few specialists who had an interest in his monograph; hence it remained at first practically unknown. For all that, it became thenceforward the guiding principle of his whole life and the fundamental basis of his science, his art, his philosophy, and his religion, in short, of his *Welt- und Lebensanschauung*.

Haeckel was above all things a fearless guardian and champion defender of his science. During the storm and sterss period of the new doctrine he was swordsman and standard-bearer at the same time. On the 19th of September, 1863, at the meeting of the "Society of German Physicians and Naturalists" at Stettin, he championed Darwin's theory of evolution for the first time in a public speech. With convincing logic and in classic diction—he

was a master of his native tongue—he presented its fundamental ideas, showing that all plants and animals of our time as well as all organisms which have every lived on earth had not been created individually, each a species by itself—as we had been taught from childhood up—but had evolved gradually in the course of many millions of years, and in spite of their great diversity from a very few, perhaps from a single form, an extremely simple organism. Man must therefore first seek his forebears among the apelike mammals, then further back among the kangaroo-like marsupials, still further back in the so-called second period or Mesozoic age among the lizard-like reptiles, and finally in a still earlier period, in the Paleozoic age, among the primitive fishes. The evolution-theory of Darwin, Haeckel declared, will be of the same importance for organic nature as Newton's law of gravitation has been for inorganic nature. The young Jena professor was, however, unable to enthuse many of his hearers for the new doctrine. Especially the older leaders in bilogical science declared it untenable and foolish, not suspecting what folly they themselves were committing, for not many years afterward Haeckel became the leader in the combat and an army of enthusiatic followers gather about him, the now far-famed German Darwin.

The great controversialist turned his words into deeds. In the year 1866 his first work of importance, *General Morphology,* appeared, making a profound impression, for it was at once recognized as the harbinger of a new era in biological science. To-day it is universally acknowledged as the dividing-mark between the pre-Darwinian and the modern age, presenting the ultimate conclusions of the Darwinian doctrine for the entire realm of biology. In it Haeckel undertook the reconstruction of the whole edifice of morphology from the foundation up, by showing that henceforth the investigation of the historic develop-

ment of the organisms inhabiting our earth, i. e., the study of phylogeny, the history of the tribe, must become the chief business of morphologists. To facilitate this, he took pains to work out the methods which would lead to that goal. The *General Morphology* contained, as it were, the program of his whole life-work out of which all his later productions grew.

The first attempt to bring the entire knowledge of the animal world into a logically arranged system was undoubtedly made by Bronn, the first translator of Darwin's *Origin of Species* into German, in his *General Zoology* which had appeared in 1850. Bronn was then still influenced by the botanist De Candolle, who, though progressive and later an ardent supporter of Darwin, had sought the *summum bonum* of biological science in purely systematic work, advocating a natural classification according to external characteristics; he had long been superseded by Schleiden's critique. Therefore, Bronn's book had lost its function as a legacy to coming generations even before it was in print.

Schleiden had assigned to botany the task of investigating the form and function of the cell; from his school came the stimulus for a new and timely system of zoological science, and the man who was called upon to apply the division of botany into morphology and physiology to the realm of zoology was Ernst Haeckel. But while Schleiden emphasized the importance of the embryological method and of the cell as the elementary organ of plants, Haeckel laid chief stress upon the theory of descent, using it as the Archimedian point from which he lifted the world of old methods off its hinges. He applied the evolutionary principle not only to the organic but also to the inorganic sciences, by basing his positive philosophical view—his "law of substance," which he posited as a fact—upon the assumption that we know nature in its entirety as a system

of moving forces which inhere in matter, compelling us to classify the totality of our knowledge according to the various kinds of motions. We must, therefore, distinguish two factors in the study of organisms, viz., forms and functions, which necessitates a differentiation of biology into morphology and physiology, a distinction already demanded for botany by Schleiden. Haeckel, however, went to his problem in a much more thoroughgoing fashion. His systematic mind tolerated no gaps. He not only undertook to clearly define the distinctly separate functions of the two biological branches but also so to arrange and group all the activities of the botanist and zoologist that they could be subsumed under those two chief categories. And he accomplished his task. He united in his system the two tendencies of his predecessors by deriving, on the one hand, his chief divisions from the fundamental principles of a popular philosophical theory of knowledge which made the system generally acceptable, and, on the other hand, subsumed under these divisions the sum total of contemporaneous science. Herein lies the true historical significance of Haeckel's work, and the eminently practical value of such a solution of the long-felt conflict fully explains why this system could control all natural science for four decades in spite of the fact that its philosophical foundation is very debatable.

Haeckel ascribed to the science of the evolving form of the organism the same value as to the science of the completed form and hence divided morphology into the two coordinated branches of anatomy and morphogeny or embryology. Further subdivisions of anatomy into the science of structure, or tectology, and in promorphology include the principle of differentiation of individual types, i. e., the presentation of Haeckel's theory of individuality which distinguishes six grades of organisms, the discussion of which would, however, lead us too far afield. The division

of morphogeny into embryology of individuals or ontogeny, usually called embryology proper, and embryology of tribes or phylogeny, completed Haeckel's far-reaching plan of a General Morphology.

The chief features of this he later embodied in his trenchant inaugural address on "The Growth and Task of Zoology," delivered in 1869, in the university assembly-hall at Jena, when he entered the Philosophical Faculty as *Professor ordinarius* and defined the duties and prerogatives of the new chair of zoology to which he had been appointed in 1865. He started out by characterizing the two kinds of systematic science "as the external classificatory system of the general public whose ideal of the biological sciences is a complete herbarium and zoological museum, and that system which in the natural classification of organisms recognizes the hypothetical expression of its real genealogical tree and in the approximate establishment of which it pursues a high and difficult scientific aim." He then continued: "The systematology of the first kind, viz., museum zoology and herbarium botany, as it has been largely pursued hitherto, hardly deserves the name of a science. For, every science as such must be able to produce a certain sum of general results and laws, it must strive to interpret phenomena and search to find its causes; it dare not be satisfied with the mere knowledge of single scattered facts. But the latter is quite surely the case with pure systematology. An exclusively descriptive natural history can never lay claim to being called a science .... True, descriptive systematology is just as indispensable as the collections themselves, and the whole application of zoological and botanical knowledge to practical life is dependent upon it. However, a practical and applied science is no science at all but an art, and we shall, therefore, have to consider the purely descriptive classification of plants and animals as an art like the practice of medi-

cine, pharmacy, and agriculture to which it, especially, renders service. Entirely different from this artificial method of work is that truly scientific systematology which presents the natural classification of the species of plants and animals as their true genealogical tree." This distinction embodies Haeckel's greatest and most enduring service to science.

Applying the results of embryology, with special emphasis on the biogenetic law, also to anthropology, he made the difficult attempt, obeying his passionate desire for ultimate conclusions, to outline the developmental history of the whole organic world and wrote a *Natural History of Creation* which appeared in 1868. Being of a popular nature, it went through many editions and was translated into at least fifteen foreign languages. This was followed in 1874 by a more scientific work on *Anthropogeny,* or the evolution of man proper. These books were discussed for years with extreme animation, but when after the lapse of almost a quarter of a century Haeckel gave a summary "On Our Present Knowledge of the Origin of Man" at the International Congress of Zoologists at Cambridge in 1898, he met with entire accord from this forum of international science.

Science demands above all things concrete proofs. We, therefore, find our Jena savant constantly and indefatigably at work in his laboratory, as is amply shown by his voluminous monographs on the embryology of the siphonophores and the calcareous sponges. Toward the end of the sixties embryology had through the epoch-making researches of the Russian biologist Kovalevsky gained the foreground of zoological investigation; however, only Haeckel saw the full significance of these discoveries and their importance for systematology. His interpretations of these new discoveries, therefore, advanced the development of the genealogical system of classification by leaps and bounds. On

the basis of Kovalevsky's and his own discoveries in the realm of invertebrate embryology, he worked out and established during the years from 1872 to 1884 the ingenious conception of his famous "gastræa theory." From the fertilization of all multicellular animals there develops after complete cell-division a primitive germinal structure which in all normal cases resembles a miniature thimble consisting of two layers of cells and a primitive mouth, or blastopore, along the margin of which the two cell-layers merge. This phase of the embryo's development is called the gastrula stage. From it gradually all the organs of the body develop. The systematic importance of the gastræa theory culminates in the following trenchant conclusion: "The whole animal kingdom is divided into two large groups separated by the gastrula form; one of these groups is composed of the primitive unicellular animals or Protozoa, and the other of the six higher tribes or phyla which are designated as germ-layer animals or Metazoa." This apparently simple and insignificant division of the animal kingdom has become of the greatest importance for the full understanding of the general relation of the animal phyla, for many of the later morphological discoveries find here their proper interpretation, expressed by the simple statement that all higher or more complex animals are derived from the common ancestral form of the gastræa which possess a monaxical body composed of two layers of cells, the ectoderm and the endoderm, and the cavity of which opens at one pole through the primitive mouth. Though the attempts of Haeckel to explain the relations between all the various individual types partly failed, they nevertheless led to a series of similar attempts which characterize the systematic efforts of subsequent years.

Within a further decade Haeckel published the astounding results of his extensive explorations in foreign lands and seas: a completed monograph on the Radiolaria of

which he discovered and named something like four thousand new species, an eloquent testimonal of his investigating genius as well as of the thoroughness of his linguistic knowledge. Counterparts of this work are his monograph on the Medusæ or jelly-fishes and his report on the results of the British Challenger expedition. But his most monumental production, in which he sums up the results of more than thirty years of scientific research, is his *Systematic Phylogeny,* published in three volumes from 1894 to 1896, a "sketch of the natural system or organisms on the phylogenetic basis" which contains the pedigrees of all the larger divisions of the animal and plant kingdom.

Haeckel's theories, however, did not find ready recognition, especially among the older scientists, while the more ambitious youth of Germany recognized in him a new prophet and leader. They flocked to his lecture-room and laboratories in large numbers, attracting quite a few foreigners who likewise looked upon Haeckel as the final architect of the evolutionary structure started by Kopernicus, Kepler, and Newton, continued by Lyell and put under roof by Darwin and Wallace but illuminated and furnished by Spencer and Haeckel. Nevertheless, the Jena professor was attacked on all sides, especially after the principle of natural selection which he staunchly upheld had been declared insufficient as the chief factor in the explanation of the origin of species.

But even previously violent discussions had taken place. Especially at the golden jubilee meeting of the "Society of German Physicians and Naturalists" in Munich in 1877. Virchow, Pettenkofer, Nägeli, Waldeyer, and Haeckel, leaders in the biological thought of the times, were the chief combatants for and against the new doctrine of descent. It was a battle of the giants. Pettenkofer, the physiological chemist of Munich, spoke first, entirely ignoring the delicate subject. Waldeyer, the Berlin anatomist, fol-

lowed condemning Darwinism in unmeasured terms, whereupon Haeckel arose and delivered his first comprehensive public address on the theory of descent and its application to all spheres of life and knowledge, including education, morality, and religion. It was a fulminating speech arousing admiration and ire at the same time. Virchow answered; he counseled moderation but did not refrain from sharply criticizing Haeckel's view on the origin of the human race and his cellular psychology, protesting against its teaching in the schools and warning his hearers against the dangerous influence of such theories upon the constantly increasing demagoguic intrigues of the Social Democrats. The deafening applause which followed easily showed the preference of the audience. Haeckel answered with a brochure entitled *"Freie Wissenschaft und freie Lehre,"* the most brilliant production of his pen, but the dice had been cast, Haeckelism as such had, for a while at least, received a severe blow. Even his party organ *Kosmos* dared not defend him; on the contrary, it admonished its readers not to wound the nation's religious feelings, for, the tendency of the average man was then and is now to endorse what Darwinism destroys and look with indifference upon its constructive mission. In 1882 the publication of the magazine was discontinued.

The chief objection to Haeckel's dogmatism was his application of the theory of descent to the human race. He regarded the following as the last stages in man's ancestral line: (1) the earlier Cynopithecus (baboon and long-tailed monkey); (2) the later Cynopithecus (senile and proboscis-monkey); (3) early man-apes (gibbons); (4) later man-apes (orang-utan and chimpanzee); (5) ape-man (*Pithecanthropus erectus*, the Java man); (6) primitive man (*Homo primigenius*, Neandertal man); (7) *Homo sapiens*. Nevertheless, whether we agree or not with the phyletic hypothesis advanced by Haeckel for the elucidation of the human

genealogical tree in the course of fifty years, one thing must be granted—he opened up the question and interested the great educated public in it, eventually compelling even the churches to recognize its validity, while specialized science finally made it an integral part of specific anthropology.

Being rigorously consistent in his arguments, Haeckel naturally constructed his philosophy of life, his moral code, and his religion upon the foundation of his world-conception as formulated in his aforementioned "law of substance": that we know nature in its entirety only as a system of moving forces which inhere in matter. Granted the truth of this premise, his monistic philosophy, culminating in his discourses on morality and religion, is logically correct. It is, therefore, not surprising that his extremely stimulating books dealing with these subjects and published within the last twenty or more years have found a multitude of readers throughout the civilized world and have been translated into many languages. *Homism as a Bond Between Religion and Science, Confession of Faith of a Naturalist, The Riddle of the Universe, Wonders of Life, The Problem of Man,* etc., all are stirring books which have aroused a flood of controversial literature. Some six years ago a Hindu professor visited Haeckel and asked his permission to translate *The Riddle of the Universe* into his native tongue, assuring him that the book would be sold in India in hundreds of thousands of copies, and the assurance was verified.

Haeckel denies all purpose or design in nature, the existence of a special vital force, moral order or human freedom. Moral life forms only a part of the cosmic unit; there are not two different worlds, a physico-material and an ethico-immaterial with an immaterial God, its creator, sustainer, and ruler. On the contrary, we can recognize only one substance in the universe which is at once "God

and Nature," not, however, in the sense of materialism which denies the existence of spirit, nor in the sense of spiritualism which rejects the notion of matter, but in the sense in which Spinoza—according to Haeckel—defines it: "Matter or infinitely extended substance, and spirit (energy), or sensitive and thinking substance, are the two fundamental attributes or principal properties of the all-embracing divine essence of the world, the universal substance." Haeckel's philosophy consequently recognizes only one single, all-comprehensive enigma, the "problem of substance," i. e., the inquiry into the real character of what the realistic scientist calls Nature or the Universe, the idealistic philosopher Substance or the Cosmos, and the pious believer Creator or God. To him it represents all the issues of life and death, of character and attainment; it is the great balm which brings consolation to the sorrowful and condemnation to iniquity.

But Haeckel acknowledges that the riddle cannot be solved: "The essence of substance becomes more mysterious and enigmatic the deeper we penetrate into the knowledge of its attributes, matter and force or energy, and the more thoroughly we study its countless phenomenal forms and their evolution. We do not know the 'thing-in-itself' that lies behind these knowable phenomena." Nevertheless, while he acknowledges the impossibility of solving the *problem* of substance he rejoices in the firm establishment of the *law* of substance, the fundamental law of the constancy of matter and force, the most far-reaching discovery of the nineteenth century, on which rests his monism of the cosmos, proving to his own mind that there is no personal God, no immortal soul, no free will. Hence, the universe is to him only a complicated machine in which vibrating atoms with their inherent forces of attraction and repulsion form the wheels that may now accumulate into a fiery sun and now into a beetle, that may now roll

as planets through the universe and may now cause man to act as a thinking and free being. From the gloomy *problem* of substance he thus claims to evolve the clear *law* of substance. He naturally assumes that the problem of the universe is a scientific problem and scornfully rejects the introduction of metaphysical methods.

Science, however, deals with facts and asks the question what is their nature and order of sequence, under what generalizations may the facts and their sequence be comprised, while the inquiry into the source and origin of the facts, the question why there is an experience at all and why the sequence presented therein is what it is does not concern science as such but is a metaphysical question. It is precisely this which constitutes the riddle of the universe. Professor Haeckel, notwithstanding, uses the same monistic key to unlock the mysteries of anthropology, psychology, cosmology, and theology, and since the key does not fit all these locks calmly breaks them. Man's relation to the rest of the world, the soul's relation to the body—soul to him is merely the sum of vital phenomena, i. e., of physiological nerve-processes—and the relation of all these to the cosmic substance are explained empirically or inductively, and upon a brilliant array of empirical demonstrations his monism, which constitutes the bond between religion and science, is deductively established. The law of substance manifests itself in the world as the law of evolution of the conservation of energy and matter, in the organic world as that of the evolution of matter, more specifically in the so-called psychic world as the law of the evolution of energy, in the moral world as the law of the supreme rule of energy over matter. Consequently, psychology is a part of physiology which legitimately employs observation, experiment, and deductive speculation, the psychic functions being dependent upon certain chemico-physical properties and subject to metabolic changes. All processes of psychic

origin belong therefore to the sphere of cellular physiology, and we may hence call the whole presentation a system of "Cellular Psychology." Consciousness, emotion, reason, and will are bound up with a reflex arc which consists of one-, two-, three-, and four-celled organs respectively, and are the result of gradual evolution of cellular development from the protists to man. Consequently, Haeckel explains the rise of the moral sense which he calls the essence of religion, as the gradual result of the apprehension of the useful, eventually becoming a necessity of peaceful social intercourse and finally leading to the recognition and observance of the true, the good, and the beautiful.

It seems as though Mendel's law of inheritance and the new science of genetics resulting from its application endorsed Haeckel's empiricism. For, it proclaims a mechanism of inheritance present in every cell which by its dominants and recessives determines the physical and mental qualities transmitted from parent to offspring. Consequently, the mechanistic view of life is to-day the prevailing principle of modern biological investigation. But such a conception will never lead to an appreciation of moral obligations. Haeckel firmly upheld it and organized thirteen years ago with enthusiastic fervor the "Monistic League" which is now presided over by Prof. Wilhelm Ostwald, the world-renowned founder of physical chemistry, who through his monistic *Sunday-sermons* has gathered a host of followers around the monistic banner.

But if we recognize a difference between the entities of time and space we must grant metaphysics as rightful a claim as science. Accordingly, the problem of substance belongs entirely to the sphere of metaphysics. The eminent botanist Johannes Reinke of the University of Kiel goes even farther when he says: "A knowledge of nature leads unavoidably to the idea of God, and we are, especially according to the laws of nature, in my opinion as sure of

the existence of God as we are of the existence of nature. Therefore the assumption of God is not fiction but induction."

Summing up our estimate of Haeckel, we must grant that he fought all his life honestly and untiringly for the highest ideals of humanity as he saw them; the enthusiasm which lifted the labors and results of his reason upon the plane of a pious faith and made them an affair of his heart places him far above the orthodox religious fanatics who in lock-step fashion follow ancient traditions.

Haeckel, the naturalist; Haeckel, the great apostle of Darwin and founder of genealogical classification; Haeckel, the inspiring teacher of a brilliant array of leading biologists; the master-type of man who on the stormy sea of life never lost his rudder—he surely will live on in the annals of the world's history: a fearless champion of academic freedom and religious liberty.

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THE ANALYTICAL TREATMENT OF NEWTON'S PROBLEMS.

IT is a great help to the proper understanding of the meaning of Newton's propositions to consider the formulation of these propositions in analytical language. In this article, after a mention is made of Leibniz's analytical work of 1689 (§ I), Varignon's of 1690 (§ II), Maclaurin's of 1742 (§ III), and of some work of Johann Bernoulli, Keill, Hermann, and others near the beginning of the eighteenth century (§ IV), the contributions of Lagrange (1788) and the integrals of the dynamical equations are considered in greater detail (§§ V, VI). In connection with these integrals, the problems of the first three and then two bodies are treated in the most general way possible (§ VII), and, in § VIII, a simple case of integration noticed by Jacobi is given and some further simplifications added. In § IX a short analytical summary of much of Newton's work on the dynamics of a particle is given. In § X the work of Möbius, Hamilton, and Grassmann on vector methods, which is of such great importance to analytical mechanics, is indicated, and the logical problem of the principles of mechanics and the light thrown on it by this work are discussed.

I.

The first memoirs that we shall have to consider are two by Leibniz. The *Acta Eruditorum* of Leipsic gave in

1688 a very long review of Newton's *Principia,* and in 1689 appeared in these *Acta* two papers by Leibniz entitled "Schediasma de Resistentia medii et Motu projectorum gravium in medio resistente"[1] and "Tentamen de Motuum Caelestium causis,"[2] the latter of which may be described[3] as an attempt to combine Cartesian and Newtonian ideas. Leibniz stated[4] that he had not seen the *Principia* when he wrote these papers, but that he had seen the above review. Not being able to understand by what methods the most important of Newton's discoveries as described in that review, viz., the elliptical motion of the heavenly bodies, could have been proved mathematically by Newton from the data obtained by observation and law of attraction governing that motion, Leibniz gave this proposition as deduced by himself with the help only of his infinitesimal calculus. Leibniz obtained[5] the equation of the centripetal force, which is certainly in accordance with Newton's sixth Proposition of his first Book but cannot be said[6] to "coincide with it"; for Leibniz found, in a somewhat different notation, the now well-known equation for the force acting along the radius vector.

[1] *Leibnizens mathematische Schriften* (edited by C. I. Gerhardt), Abt. II (which is Vol. VI of the 3d series of G. H. Pertz's edition of *Leibnizens gesammelte Werke*), Halle, 1860, pp. 135-143.

[2] *Ibid.*, pp. 144-161. Another manuscript of Leibniz and a letter to Huygens, both relating to this paper, are printed in *ibid.*, pp. 161-193. Cf. also Gerhardt's remarks, *ibid.*, pp. 10-12.

[3] Cf. Rosenberger, *Isaac Newton und seine physikalischen Principien,* Leipsic, 1895, pp. 231-232.

[4] According to Brougham and Routh (*Analytical View of Sir Isaac Newtons' "Principia,"* London, 1855, pp. 438-439). However, in Gerhardt's publication, in neither of these two papers does Leibniz mention the fact that he himself was at Rome when the papers were written, and only in the second Newton is mentioned. On the subject of the law of gravitational attraction Leibniz says (Gerhardt's ed., p. 157): "Video hanc propositionem jam tum innotuisse etiam viro celeberrimo Isaaco Newtono, ut ex relatione *Actorum* apparet, licet inde non possim judicare, quomodo ad eam pervenerit."

[5] Gerhardt's edition, pp. 156-157; cf. pp. 176-178.

[6] Brougham and Routh, *op. cit.*, p. 441.

II.

In 1690, Varignon published a paper in which he translated mechanical conceptions into terms of Leibniz's calculus, writing dx/dt for the velocity (v) and d^2x/dt^2 or dv/dt for the acceleration, and so on. Rosenberger[7] said that this translation was made here for the first time, but this remark, by what we have seen in the first section, would seem to be a mistake.

III.

A systematic use of a fixed origin of coordinates, and indeed rectangular coordinates, x, y, and z, was first made by Maclaurin in his work: *A Treatise of Fluxions,* published at Edinburgh in 1742.[8] The use of fixed directions along which to resolve forces makes it possible to write out the equations of motion much more simply. In fact, we know that, in the case of a stone whirled round at the end of a string for instance, the result of the action of a force may be to change constantly the direction of motion of a body without bringing it any nearer to the attracting center of force. When Huygens and Newton investigated the motion of a particle revolving in a circular orbit round the center, they found—in modern notation—that there was an acceleration along the radius vector r of amount $r(d\vartheta/dt)^2$, although the particle never approaches the center of the circle. The velocity along r is measured by dr/dt, but the *acceleration* along r is not measured by d^2r/dt^2; a term due to the change in the direction of the velocity must be taken into account. We calculate this in the simplest way when we find the velocity and acceleration along r from the observation that the velocities and accelerations along the axes of x and y are dx/dt, dy/dt, and d^2x/dt^2,

[7] *Op. cit.*, p. 229.

[8] Vol. I, pp. 386-390 (arts. 465-469), and Vol. II, p. 710 (art. 884).

d^2y/dt^2, respectively, and that:

$$x = r\cos\vartheta,\quad y = r\sin\vartheta.$$

We then find that the acceleration along r is

$$(d^2x/dt^2)\cos\vartheta + (d^2y/dt^2)\sin\vartheta = d^2r/dt^2 - r(d\vartheta/dt)^2,$$

while the acceleration perpendicular to r is

$$(d^2y/dt^2)\cos\vartheta - (d^2x/dt^2)\sin\vartheta = (1/r)d/dt(r^2\,d\vartheta/dt).$$

It is to be observed that Maclaurin was the first to use Cartesian coordinates systematically in mechanical problems, and that Euler in 1736 and D'Alembert in 1743 used what are called "intrinsic" or "natural" coordinates.[9] In particular, Euler seems to have been the first to give explicitly the now well-known formulas expressing the tangential and normal accelerations of a particle describing a curve.

IV.

Johann Bernoulli (1710), in a letter to Hermann which was published in the *Mémoires* of the French Academy, gave the proposition $f = h^2r/p^3\varrho$, which I consider in another article. It was afterward given, in different wording, as a deduction from the sixth Proposition of the first Book in the second edition (1713) of Newton's *Principia*. Keill[10] gave a demonstration of Bernoulli's theorem which was much more roundabout, and as of a theorem which Demoivre had communicated to him, adding that Demoivre also informed him that Newton had invented a similar matter before.[11]

In the same paper Bernoulli maintained that Newton had assumed without demonstration that no other curves than conics can be the trajectories of bodies moving under the influence of a centripetal force varying inversely as the

[9] See the description and references in the *Bulletin of the Amer. Math. Soc.*, Vol. XXII, 1915, pp. 139-141.

[10] *Phil. Trans.*, Vol. XXVI, p. 74.

[11] Brougham and Routh, *op. cit.*, pp. 46-48.

square of the distance. It certainly cannot be maintained that Newton's phraseology in his seventeenth Proposition is free from ambiguity, but, according to Brougham and Routh,[12] this accusation brought by Bernoulli is not correct. Newton "certainly gives a very concise and compendious demonstration, but he states distinctly that, the focus and point being given, and the tangent given in position, a conic section may be described which shall at that point of contact have a given curvature; that the curvature is given from the velocity and central force being given; and that two orbits touching each other cannot be described with the same centripetal force and velocity. . . . But it must also be observed, as Laplace has remarked, that Newton has in a subsequent problem shown how to find the curve in which a body must move with a given velocity, initial direction, and position; and since when the centripetal force is inversely as the square of the distance the curve is shown to be one or other of the conic sections, he has thus demonstrated the proposition in question; so if he had not done so in the Corollary to one problem, he has in the solution of another."[13]

However, in quite modern times, Paul Stäckel[14] has said that "Newton deduced his law of attraction from Kepler's laws. That conversely a central force inversely proportional to the square of the distance always leads to a Kepler's motion in a conic section was then shown by Johann Bernoulli."

In the same paper, Bernoulli objected to a solution of the inverse problem given by Hermann in the same volume

[12] *Ibid.*, pp. 58, 62.

[13] "*Système du Monde*, liv. V, chap. V. It is to be observed that the seventeenth Proposition of Book I is exactly the same in the first as in the subsequent editions, except for the immaterial addition of a few lines to the demonstration. Consequently, Bernoulli must have been aware of it when he wrote in 1710."

[14] "Elementare Dynamik der Punktsysteme und starren Körper" (1908), *Encykl. der math. Wiss.*, Vol. IV, Part I, 1901-1908, p. 494.

of the *Mémoires,* which had been communicated to him before it was presented to the Academy, in which use was made of the expression $-d^2x\sqrt{(x^2+y^2)}/x$ for the centripetal force. Bernoulli's objection was that the manner of working out the problem showed that Hermann was previously aware of the solution in the case of the conic sections. Further, Hermann omitted a constant in his integration, and, by adding it, Bernoulli showed that the equation which Hermann found, when thus corrected, expresses the conic sections generally.[15]

V.

A great change in the treatment of mechanical problems came about as a consequence of the work of Lagrange. With the gradual development of Lagrange's method of dealing with the general problem of dynamics I have dealt in the supplementary volume to Mach's *Mechanics.*[16] Here we must notice that Lagrange, by reducing all the problems of analytical mechanics to the systematic development of one set of equations, almost accomplished the enormous progress of making of mechanics a subject of pure mathematics. The whole question of the motion of mutually attracting particles thus came to be a very small part of Lagrange's inspired routine,[17] which was greatly developed by Poisson, Hamilton, Jacobi, and many others.

In the work of these men the problems of dynamics were reduced to the transformation and integration of the differential equations of mechanics. Of course, there was a reaction against this analytical tendency, and the often contrary tendencies of the work of Poinsot, Thomson and Tait, and Helmholtz give examples of this. Of the vec-

[15] Brougham and Routh, *op. cit.,* pp. 58-59.

[16] Chicago and London, 1915, pp. 90, 96, 98-99.

[17] Cf. *Méchanique analitique,* Paris, 1788, pp. 262-265, 288-295.

torial methods associated with the names of Grassmann and Hamilton we will speak later.

Newton was much occupied with the demolition of Descartes's theory of vortices, and consequently paid some attention to the motion of particles in resisting mediums. But when it came to be believed, principally as a result of the great success of the Newtonian treatment of gravitation, that the forces which appear in the important problem of astronomical dynamics act at a distance and not by means of a medium, the question of resistance and friction rather fell into the background, at least with theoretical men of science whose interest was concentrated on problems of celestial dynamics. Thus Lagrange, writing toward the end of the eighteenth century, hardly touched upon the motion of a particle in a resisting medium, and his example was followed by Jacobi and Kirchhoff.[18]

One point that comes out very strongly in Lagrange's reduction of the dynamical problem is the clear separation of the principles of mechanics into those theorems of a general nature that give us integrals of the dynamical equations, and those principles that give us the dynamical equations themselves.[19] Thus, the "principle of *vis viva*" of Huygens, Johann Bernoulli, and Daniel Bernoulli gives us a finite equation between the velocities of the bodies considered and their coordinates in space, so that if there is only one such coordinate the equation obtained from the principle spoken of is sufficient completely to solve the problem. This is the case with the problem of the center of oscillation. In general, the principle mentioned gives a first integral of the mechanical equations. Again, when there is no outer force acting on a system of bodies, we at once get an equation expressing that the coordinates of the

[18] *Encykl. der math. Wiss.*, Vol. IV, Part I, p. 472.

[19] *Méchanique analitique*, pp. 184-188; *Ostwalds Klassiker*, No. 191, pp. 76-77.

center of gravity of the system have their second differential quotients equal to zero. These three differential equations can be immediately integrated and give three first integrals of the system of mechanical equations, expressing that the velocity of the center of gravity is constant. These three equations can be integrated again and give three more integrals of the system of equations. Lastly, we have what is known as "the principle of the conservation of areas," which was discovered in the period 1743 to 1746 by Daniel Bernoulli, Euler, and D'Arcy under somewhat different forms. In D'Arcy's original form the principle appears as a generalization of Newton's theorem on the equable description of areas; and is that the sum of the product of the mass of each body by the area that its radius vector describes round a fixed center is always proportional to the time. In 1749 and 1752 D'Arcy gave his principle in the equivalent form of the constancy of the sum of the products of the masses, the velocities, and the perpendiculars drawn from the center on the direction of the velocities.[20]

Lagrange contrasts with these principles, which give integrals of the system of dynamical equations, the "principle of least action," which gives, at least in the form which Lagrange gave it, a condensed formula for the whole system of these equations.[21] To this principle, we may add Gauss's principle of least constraint and Hamilton's principle.[22]

VI.

Lagrange stated the object of his *Méchanique analitique* of 1788 to be to "reduce the theory of this science and the art of solving its problems to general formulas of

[20] *Ostwalds Klassiker*, No. 191, p. 84.

[21] Cf. Jourdain, *The Principle of Least Action*, Chicago and London, 1913, pp. 75, 78.

[22] These principles, which do not give integrals but transformations of the equations of motion, are discussed in *Ostwalds Klassiker*, No. 167, and Jourdain's *Least Action*.

which simple development gives all the equations necessary for the solution of each problem." In his book there were no figures: "The methods exposed do not require geometrical or mechanical constructions or reasoning, but merely algebraical operations in a regular and uniform progress." It results from this that new light was thrown upon the various principles of mechanics, for we can only see clearly the nature and limitations of the methods used for the solution of problems of dynamics when we write out in the most general way possible the equations which hold the solutions and then see how the search for integrals is conducted. It then appears that, for example, the theorem of the equable description of areas is a particular case of the fact that a certain combination of our dynamical equations is at once integrable.

All the three general theorems that we have mentioned which give integrals, hold good in problems on the motion of n mutually attracting bodies for which resistance of a medium is not to be taken into account. This is the important case of the differential equations of astronomy, and the problem of the "integration of the equations of mechanics" is usually assumed, after Jacobi, to mean the integration of a system of ordinary equations of the second order for which integrals can be found by the above three principles. It may be remarked that the integrals given by the principle of the center of gravity are six in number of which three are "first integrals," that is to say, if φ is a function of the coordinates, the time, and the velocity, and in virtue of the equations $d\varphi/dt = 0$, then the equation $\varphi =$ a constant is a "first integral."[23]

VII.

Let us now consider the problem of three mutually attracting particles in space. We shall then see an easily

[23] On integrals of the equations of mechanics, see *Encykl. der math. Wiss.*, Vol. IV, Part I, pp. 462-469, 474-478.

generalized instance of the differential equations of dynamics for which all the three integrals mentioned hold good, and can then treat the problem of two particles as a particular case. It will clearly be of great advantage to consider the problem quite in general and not introduce any simplifying conditions about the selection of axes.

We will, then, take up the equations of motion in the form given to them by Lagrange, and in which everything depended on differential quotients of half the *vis viva,* or T, and the force function or negative potential energy U, for the case of three mutually attracting particles. In this case we will point out the way to find the integrals, and then point out how Newton's problem of two bodies can be solved by this very general routine method which throws so much light on the particular treatment of dynamical problems.

Each Lagrangian equation is of the form

$$(d/dt)\ (\delta T/\delta q') - \delta T/\delta q = \delta U/\delta q,$$

where q is the general type of a generalized coordinate, q' denotes dq/dt, and the deltas denote partial differentiations. If we have three mutually attracting particles, each of them perfectly free in space, the generalized coordinates are nine in number, and consequently there are nine Lagrange's equations of motion. If the generalized coordinates q are rectangular coordinates, the function T is a homogeneous quadratic function of the terms q' and does not contain any terms q; so that the second term on the left of each of Lagrange's equations vanishes. The problem of finding integrals then reduces to the combination of all the terms with one another and with coefficients in such a way that they form a complete differential with respect to the time.

Thus, if we multiply each equation throughout by the differential quotient with respect to t of its appropriate q,

and add all the equations, we get, after some simple mathematical transformations, the result

$$(d/dt)(T-U)=0,$$

which is at once integrable and is the equation of *vis viva*. Again, it is easily seen that, in the case of gravitation,

$$U=-m_1m_2/r_{1,2}-m_1m_3/r_{1,3}-m_2m_3/r_{2,3},$$

where $r_{1,2}$ is the distance between m_1 and m_2, and so on. Then we get three equations of which one is

$$\delta U/\delta q_1+\delta U/\delta q_4+\delta U/\delta q_7=0.$$

Here we have, when we substitute for $\delta U/\delta q$, a set of three equations which are immediately integrable twice over. These are the integrals given by what is known as the "principle of the conservation of motion of the center of gravity."

In the third place, we can get, if for simplicity we represent by p with an appropriate suffix the expression $\delta T/\delta q'$ with its suffix, three other equations of which one is

$$(d/dt)\,(q_1p_2-q_2p_1+q_4p_5-q_5p_4+q_7p_8-q_8p_7)=0.$$

These integrals represent what is known as the "principle of the conservation of areas."

Whatever the number of the bodies may be, we always get these seven first integrals of the system; but when we go beyond two bodies these integrals are not enough in number to solve the problem. Except in certain special cases, which unfortunately happen to be of great practical value to astronomers dealing with the question of the motions of the sun, earth, and moon, the problem of three bodies has not yet been solved. Indeed, fairly recently H. Bruns has proved strictly that there are no other algebraic first integrals of the problem of n bodies than those seven mentioned. It must be remembered that the three first integrals of the principle of the center of gravity can be immediately integrated again, so that we have ten in-

tegrals in all. The problem of three bodies has been reduced still further, but it is not necessary to speak of that in this place.

It is of great interest to see how Lagrange treated the problems of two and more bodies in his *Méchanique*. He found that it is always possible to refer the bodies to moving axes through any one of the bodies the coordinates of which do not depend merely on the position relative to this body (m) being capable of elimination by means of the integrals of the principle of the center of gravity. Thus the motions of other bodies round m could be determined by differential equations. If we descend to the case of two bodies, we find without difficulty that the same equations hold as for motion of a body round a fixed center of force; and this is one of the great discoveries of Newton to which we refer in another article.[24]

VIII.

The shortest method of integrating the equations of motion of a single particle in the xy-plane under the influence of a central force varying inversely as the square of the distance was given by Jacobi in 1842.[25] We have, since $x = r\cos\vartheta$ and $y = r\sin\vartheta$, and thus $x/r = \cos\vartheta$ and $y/r = \sin\vartheta$, $d^2x/dt^2 = -kx/r^3$, $d^2y/dt^2 = -ky/r^3$, where k is a constant, so that we can at once deduce

[24] For further information on the subject of the equations of dynamics we may refer to George Boole's *Treatise on Differential Equations*, 2d ed., Cambridge and London, 1865, pp. 312-315; J. Graindorge, *Intégration des équations de la mécanique*, Liège and Bruxelles, 1889; A. Cayley, "Report on Theoretical Dynamics," *Rep. Brit. Ass.*, 1857, pp. 1-42; P. Painlevé, *Leçons sur l'intégration des équations différentiales de la mécanique*, Paris, 1895; and the articles in Vol. II, Parts II and III, 1900, of the *Encykl. der math. Wiss.*, especially pp. 343-346, and the articles on astronomical mechanics in the later volumes of this *Encyklopädie*.

[25] "De motu puncti singularis," *Journ. für Math.*, Vol. XXIV, 1842, pp. 5-27; *Werke*, Vol. IV, pp. 265-288 (especially pp. 281-282). This method was simplified by Thomson and Tait; cf., for example, Tait's article "Mechanics" in the 9th ed. of the *Encyclopædia Britannica* (Vol. XV, 1883, p. 685).

$$y(d^2x/dt^2) - x(d^2y/dt^2) = 0.$$

By integrating the last equation and substituting for x and y their values in terms of r and ϑ, we have

$$r^2 d\vartheta/dt = h,$$

where h is a constant.[26] Substituting $r^2 = h/\vartheta'$ in the first pair of equations and noticing that, for example, $(d/dt)(\sin\vartheta) = \vartheta' \cos\vartheta$, we write the pair in the immediately integrable form:

$$d^2x/dt^2 = -(k/h)(d/dt)(y/r),$$
$$d^2y/dt^2 = (k/h)(d/dt)(x/r).$$

Notice that these equations are only immediately integrable because the law of force is such as to make the coefficient of the differential quotient on the right a constant. Integrating, we get x' and y'; and again using the equation $xy' - yx' = h$, we get the equation between x and y:

$$h - \alpha x + \beta y = kr/h,$$

where α and β are constants, which represents a conic section.

IX.

We may condense in a few lines the essence of much of what Newton did in the dynamics of a particle.[27]

The two equations at the beginning of the preceding section are easily expressed in polar coordinates, and by an obvious combination of them we get the first integral $r^2 d\vartheta/dt = h$. We thus find that this integral, together with the equation $d^2r/dt^2 - r(d\vartheta/dt)^2 = -R$, where R takes the place of k/r^2 for the sake of greater generality, form an

[26] Here we may remark that this integral of areas is given at once from Lagrange's equation of motion of the particle if we notice that neither T nor U contains θ, though T does contain θ'. In this case, then, Lagrange's equation reduces to $(d/dt)(\partial T/\partial\theta') = 0$. Here θ is said to be an "ignorable coordinate."

[27] Cf. Gustav Kirchhoff, *Vorlesungen über mathematische Physik: Mechanik*, 2d ed., Leipsic, 1877, pp. 7-10.

equivalent pair to the pair we started with. The integral is the principle of areas, and by it we can eliminate $d\theta/dt$ from the second equation. We thus get $d^2r/dt^2 = h^2/r^3 - R$.

Now, the equation of a conic is $r = -ex + c$, where e is the eccentricity. From this, by differentiation, and the equations of motion, we find that $d^2r/dt^2 = Rc/r - R$ if a conic is to be described under a central force. But we have found that, under a central force, $d^2r/dt^2 = h^2/r^3 - R$. Comparing these two expressions, we have $Rc = h^2/r^2$; and thus R must be inversely proportional to r^2. Conversely, if R is inversely proportional to r^2, the orbit must be a conic, and this was Newton's method of verification.

X.

The methods of geometrical analysis introduced by Möbius, Hamilton, Grassmann, and others, and known by the names of "barycentric calculus," "*Ausdehnungslehre*," "calculus of quaternions," and so on, has become of great importance in mechanics, principally owing to the conformity with mechanical ideas of the conceptions of "multiplication" in these calculi. Indeed it was Lagrange's *Méchanique* that gave to Grassmann the original ideas of "inner" and "outer" multiplication that characterized his "theory of extension." Inner multiplication has exactly the same interpretation in space as the measure of "work," and outer multiplication is interpretable as the area described by a particle revolving round a center of force in which the direction is taken into account. In the reference of moving bodies to a system of Cartesian or other axes in space, there is, as a rule, no good reason why these particular axes should be chosen rather than others[28] and this often results in very complicated formulas. The vectors which are fundamental in all of the methods of analysis mentioned can be, if we like, decomposed into three mutu-

[28] Of course this does not apply to "intrinsic" coordinates.

ally rectangular vectors along Cartesian axes, but a great advance in dealing with mechanical problems is then lost, because the parallelogram law according to which vectors, like velocities and forces, are compounded fades away from our sight.

The term "geometrical analysis" is misleading in that it seems to imply that geometrical vectors enter into the working of the calculus. But this is not the case: the analysis of vectors does not even require elementary geometrical knowledge of constructions in space.[29] It is quite possible to treat the whole of mechanics in the way of which an example was given by Lagrange. Whether this is desirable from a teacher's point of view does not concern us here: what does concern us here and what I wish to emphasize is the illumination brought to the mind of both student and teacher by the consideration of the particular artifices used by Newton and others for the integration of mechanical equations as special cases of the general theorems relating to the integrals of systems of equations of mechanics. The illumination is somewhat like the illumination given to the student when he contemplates the binomial theorem of his early work on algebra in the light of Taylor's theorem.

From the point of view of inquiry into the principles of mechanics, a combination of the purely analytical treatment of mechanical questions with the introduction of the conceptions used by Hamilton and Grassmann seems of the greatest importance. It is only when we have reached, as, thanks to the labors of Lagrange, Gauss, and others, we have done, the stage of having set up a purely mathematical model of nature in so far as the motions are mechanical, that it becomes possible to decide with accuracy whether any particular principle of mechanics is of a purely logical nature or whether it depends in the last resort on experience. In fact, if our mathematical model consists of a

[29] Cf. Peano, *Scientia*, Vol. XVIII, 1915, p. 169.

ing strictly to logical deductions. In pure mathematics the analytical tendency developed especially by Lagrange and Weierstrass can, it seems, be fully justified only by this. When, therefore, we wish to found a logical treatment of mechanics on the new conceptions of Hamilton and Grassmann, we must take care not to introduce these conceptions in a geometrical way, but must use them for the sake of the wonderful simplicity with which they allow us to formulate the principles of mechanics.

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SPACE AND THE WORLD IN SPACE.

THE postulate of the unknowable essence of things, the *Ding-an-sich*, and the unsolvability of certain cosmic riddles, the so-called antinomies, are older than Kant, and have since his day in certain quarters almost reached the value of a rock-ribbed dogma. In the words of a late exponent, Prof. Paul Natorp, the thing-in-itself is the x of an equation, the solution of which may again and again be attempted but never, fortunately, with any chance of complete success. That would be making an end of the eternal search for truth, which is one of the main blessings of humanity. *Being* is never given in its essence; it is continually being created by thought, as scientific research founded on experience advances from standpoint to standpoint. The road, the method of research, is consequently everything, the goal nothing.

While this position, possibly, on the whole is unassailable, there are generally included among the number of those riddles certain problems that to my mind really offer no great difficulty to human thought, and consequently should not henceforth be permitted to assist in discrediting our reasoning faculty, thereby furnishing consolation to the intuitionist, the mystic, and the advocate of religious superstition.

Among these I am inclined to include the problem of free will and determinism, that of time, and in part that of space.

The time has passed when theological attempts to defend the scientific accuracy of certain poetic creation myths is treated by the well-informed with anything but an impatient shrugging of the shoulders. So-called higher criticism and the comparative study of religions have attained that much. But there is really no more reason why otherwise brainy and fearless men should in our day defend the theological dogma of free will or the so-called idealistic or subjective conception of space. And yet this is, if I am not mistaken, continually being done at the great majority of universities and colleges which include philosophy among their studies.

The problem of free will has, I think, now been solved in a fairly satisfactory way by unbiased thinkers. I need only mention the excellent treatise of Prof. A. Riehl in his *Principles of Critical Philosophy*. We may say that man is free to the extent that he is able to accept distant motives for his actions instead of the immediate ones which generally determine the behavior of the brutes. And the aim of education is to furnish or elucidate those motives on the background of the highest good for the single individual, for the race, and for all humanity.

But this does not prevent every action of any importance from being rigorously determined by the external motives and by the character of the individual as formed and developed by his ancestry, his surroundings, and his own efforts. The quite unmotivated action is, according to Riehl, only found in insane asylums. Yet even the thoughts and talk of the insane are not any longer regarded as produced by evil spirits, but as the logical consequences of defects and disturbances in their own system.

One of the latest attempts to save the venerable specter of indeterminism is that of Henri Bergson, who has taken the trouble to invent a new theory of time for that purpose. He speaks of "concrete time, the time which we feel to be

the very stuff of our life," and in another place: "As regards the psychical life unfolding beneath the symbols which conceal it, we readily perceive that time is just the stuff it is made of....There is moreover no stuff more resistant nor more substantial." But even he admits that "any positive definition of freedom will insure the victory of determinism."

But the attempt to make time a substantial stuff that can act and influence physical or psychical processes, is of course utterly futile and hardly worthy of serious consideration. It is almost incredible that the personification of time in every-day speech, and by the Greeks as Kronos devouring his own children, should deceive anybody in a critical age like ours. Time is, to speak with the late Dr. Paul Carus (*Fundamental Problems*, 3d edition, Chicago, 1903, p. 287), "not a thing....it is nothing but a measure of the changes taking place around us. We employ as measures such changes as appear most regular, such as days and years. But there is no time apart from changes. Since we can imagine that some changes will always take place, and, even if they did not take place, since we could measure the time of a supposed rest by some certain measure (days, years, millenniums, billenniums), we say that time is infinite."

Things endure and change and move; but the change and the movement is, it is safe to say, not caused by a mystical entity time, but by the inherent forces of things, or if one so prefers by a Divinity. To quote Professor Riehl: "The idea of time is a concept; it does not belong to the phenomenal appearance of things....it is no intuition."

Our last problem, space, almost constantly treated on a par with time, to the great confusion of thought, is, however, not so easily disposed of. Otherwise there would

be no justification whatever for the subjective conception, which still crops up in the most unexpected places.

The idea of space is due to, and dependent on, touch and vision, and *extension* is at least a phenomenon, an intuition. That much is, I take it, generally conceded even by philosophers of the subjective schools. But their contention is that occupancy of space or the quality of extension is not a characteristic of the *Ding-an-sich,* of the reality underlying the phenomena. I suppose the standpoint is well expressed by Lotze in his *Metaphysics* (Oxford, 1884, p. 259): "There is no such thing as space in which things are supposed to take their places. The case is rather that in spiritual beings there is formed the idea of an extension in which they themselves seem to have their lot and in which they spatially present to themselves their non-spatial relations to each other." And more recently (*The Monist,* July, 1918) Prof. W. B. Smith hazards the statement that "all forms of seeing, hearing, touching, etc..... are modes of constructing or forming space-and-time symbols that are not in space and time....the real is what we all construct alike." And, consequently, he easily gains his point, that a soul is not in a body, since the body is merely a construct of that very soul.

For people endowed with a moderately vivid sense of the reality with which alone we get acquainted on this little globe; for the weary traveler who carefully keeps tab of the miles he covers, be it by rail, by auto, or on foot; for the builder who cautiously calculates his strains and stresses; and for the astronomer who measures the distances of stars in light-years, such talk can certainly not sound very convincing. They may be ready to admit the relativeness of extension and distance, as estimated by various living beings, they may take more or less stock in the modern theories of physics, which are trying to reduce the atoms to electrical energy, but they are likely to treat with

scorn the notion that the smallest units of the sense-world in their interplay should lack some kind of extension, or that the very movement itself should be a pure fiction of our imagination.

It is safe to say that the idealistic denial of the reality of extension has its main foundation in a false psychology, or in false conclusions drawn from certain psychological theories, in addition to certain unwarranted conceptions of a Divinity. To the many strange qualities of the Supreme Being, infinity was curiously enough added at an early date, in spite of the fact that it was at the same time conceived as unextended invisible spirit and even as a distinct personality. For scholastic philosophy, only God is actually infinite. Space is divided into *actual* and *possible* space, the former corresponding to the entire created material world, including the hypothetical ether. Before creation there was nothing there and no "there," for God, being a spirit, does not himself exist in space or constitute space by his being. There was merely the *possibility* that God might create extended material body and thereby so much actual space—a mental conception, an *ens ideale*. Real space is then finite, but we may say that possibilities are infinite, and so also potential space. Space is, in other words, on a par with the numerical series. (Cf. B. C. A. Windle's *The Church and Science,* p. 65.)

Scholastic philosophy is, then, dualistic and does not rob creation of a certain reality or of actual extension. But it was reserved for another theologian, under the pressure of aggressive materialistic thinking, to deny this reality and the distinction so lucidly and convincingly established by Locke, between primary and secondary qualities of so-called matter. "For my part," says Berkeley, "I see evidently that it is not in my power to frame an idea of a body extended and moved, but I must withal give it some color or other sensible quality which is acknowledged to

exist only in the mind. In short, extension, figure and motion abstracted from all other qualities, are inconceivable. Where, therefore, other sensible qualities are, there must these be also, to wit, in the mind and nowhere else."

It looks at the first glance as if the venerable bishop had truly destroyed the entire external world at one fell swoop; but on a closer inspection this is not exactly the case. Pressed on this point, he soon distinguished between our fleeting ideas and dreams and the more permanent ideas of a Divinity, the latter alone representing the visible world, so that the new theory really amounted to a denial of the then scientific conception of a material, extended, moving entity which appears to human beings in the garb of sounds and colors. In other words, as recently pointed out by Prof. Fr. Woodbridge, his starting-point was that of naive realism. The world as we observe it is all there is to it. But it is merely God's idea, it has no independent validity. There is no permanent or even transient stuff or energy constituting it, but it is continually being created by being the perception of Divinity. Its *esse* is its *percipi* and nothing else.

And this strange theory, which at bottom amounts to a terrible arraignment of the wisdom, goodness, and power of Divinity, was offered without a shadow of proof. The good bishop could not clearly imagine the state of affairs described by science, and it seemed to lead to some rather dangerous free thinking. Therefore a peremptory denial was called for and might succeed in stemming the tide. And it stemmed the tide so well among theologizing philosophers, that even to-day one time and again will meet with the statement that Berkeley once and for all proved the subjective quality of the primary characters of matter. Seeing what he really did and noticing how well he succeeded in making a bold assertion look like philosophic proof, one cannot much blame Herbert Spencer for losing

his usually polite manners, speaking of the insanities of idealism.

"Matter being once expelled drags with it so many skeptical and impious notions," wrote Berkeley. "But really," says Prof. Riehl, "it drags with it so much else of which the pious philosopher cannot have taken earnest thought....Our knowledge is indeed relative, but only so far as concerns the character of its objects. It is not relative with reference to their existence."

But even this so-called Kantian standpoint is open to grave criticism. When Kant made space and time *a priori* or necessary forms of thought, he practically reduced even extension to a phenomenon, which in itself might be entirely different from what it appears to be. While energetically denying Berkeley's contention that there is no independent reality underlying the world of appearance, he uncritically accepted the theory of the subjectivity of the character of the extension of things. The new view was supposed to come to the aid of science as against the attacks of Hume and empirical skepticism, but its immediate effect was to furnish a loophole for the possibility that the underlying basis of the visible world may lack even extension, being entirely unknowable; and so the chief gainer was after all Berkeley's idealism.

But extended things and their motion, implying empty or comparatively empty space in which they move, with real distances that make a difference, are after all too persistent to be easily brushed aside by hairspun theories, and common sense seems for once to have hit the nail on the head. Extension as we perceive it is, to be sure, a very relative affair, but it is such a necessary form of thought just because it is derived from reality, from the extended things around us by a wonderful process of evolution in living beings. The burden of proof for its non-existence, for its pure subjectivity, must necessarily rest with the ideal-

istic philosophers, who undertake to deny a palpable fact of every-day observation. But their finespun, more or less ingenious phrases are given the lie at the first move they make at their own writing-table. And serious minds should be spared the necessity of committing the greatest folly next to denying an evident truth, which according to Hume is to take much trouble to defend it.

Yet space itself gives rise to real problems and the interminable discussions seem to center around the following four: (1) Is it a reality or merely an idea, or a necessary form of thought? (2) If a reality, is it finite or infinite? (3) Does it anywhere exist as a vacuum, or is it everywhere or in part filled with a semimaterial stuff called the ether, or again is it semimaterial in its own right and uniform throughout? (4) Is it relative or absolute?

As much of the haziness which generally pervades the treatment of our subject seems to be produced by a careless confusion of space and extension, a special attempt will be made to set these two concepts apart in the following definition: Extension is our name for an attribute or characteristic of existing things, for the fact that they appear to be, and no doubt are, spread out in three dimensions. It is in so far an abstraction like form, beauty, goodness, etc., and like these may be said to lack independent reality.

Things of the same kind have necessarily different locations. If they are not contiguous we say that there is distance between them, and by distance we mean the extension of real or imaginary lines stretched out between them. Distance is in so far a term used to designate a relation between material objects. Yet the expanse (empty or filled with an invisible stuff) which makes up a distance, does not disappear when the bodies move away, and in the absence of even the hypothetical ether, we may speak of pure extension or better, with Locke, pure expansion.

We say that objects occupy space or are in space. *Empty or pure space is then, if it exists anywhere, the vacuum, the sheer emptiness, the pure expansion, the non-being, the nothing (= no-thing) which is left when existing active things are withdrawn, and which offers no obstruction to new extended bodies, but stands everywhere ready to receive something.*

This emptiness, this vacuum, can strictly speaking not be said to *have* extension. Only real objects *have* extension. It *is* pure expansion or identical with expansion. We can in imagination think of empty space as made up of larger or smaller pure expansions, and a certain expansion will give room only to things that have a definite outspread of such and such cubic content. Otherwise the science of astronomy would be pure fiction.

It is then probably futile to speak of pure space as really divisible, infinitely or otherwise. Sheer emptiness does not lend itself to real division. Only material, or possible semimaterial things like the ether, can properly speaking be divided, but not infinitely. There is the *minimum perceptibile* of common sense, and science stops at present at the electron, which one cannot help connecting with some extension, however infinitesimal. And when mathematicians speak of pure space as made up of extensionless points, they can only mean that it is a continuum and no compound (cf. Sellars, Riehl, Boodin, and others).[1]

Space is necessarily infinite and in this respect different from existing things and even from time and the numerical series which are only potentially infinite. This is a legitimate conclusion from the logical reasoning, that we cannot possibly imagine any bounds to it, which would not in their turn be either extended things filling space, or

[1] Professor Spaulding and other New Realists seem to make an entirely unwarranted use of the mathematical theory of space. It is probably safe to say that real expansion cannot be made up of quite unextended points. The analogies adduced, for instance, from single men and a crowd are clearly not to the point.

system of the universe. I confess inability to grasp this idea as applied to real space. It seems to be founded on the mathematical conception of space as built up of points and lines. Only the lines instead of being straight are supposed to be ultimately curved. This is a legitimate hypothesis for mathematical constructions, but when it is applied to three-dimensional space, our reasoning faculty balks. The trouble is that space, if treated as a slightly curved plane, would already in addition to unbounded length and width possess infinite thickness. It would, we feel constrained to believe, extend without any boundary to stop it in every direction outside of any curved plane of any but infinite thickness. You cannot make a finite globe of infinite space.

With realistic philosophers of every shade it is safe to deny that space is merely the form furnished by mind to the objective world. We regard objects as extended, because they really are extended. But I also deny that actual space is a mere abstract idea or that it is identical with the extension of things. This amounts to a denial of the possibility of empty space beyond the existing world of things, and few thinkers and scientists of note have taken this stand. The majority admits the possibility of motion infinitely in every direction, or they speak with Fullerton and the scholastics of theoretically possible space-relations of real things, or of "the possibility that quantities may be determined with reference to space" (Riehl).

But one cannot help feeling that this is a makeshift which evades the real issue, and such statements fail to illustrate the different character of space from time and from the numerical series. If space actually exists as emptiness outside of the world of things, including the ether, then it is not merely potentially infinite. It is actually infinite at any and all times, and in that respect quite distinct from duration and from the numerical series. The

distinction between reality and possibility in this connection clearly means swallowing the old scholastic subterfuge dictated by the theological necessity of denying the actual infinity of anything but Divinity.

Pure space is not properly speaking a phenomenon. It is the absence of sense-things, or phenomena. It is an inference drawn from our sight and touch experience, but it has never been seen by a human eye or touched by a human hand. There is no appearance whatever, only gaps between appearances; but our experience of the invisible air must make us cautious in denying that space may yet be filled with a semimaterial stuff. The fact that it seems empty does not warrant the conclusion that it is a pure vacuum or non-being. But if such a vacuum exists, its infinity offers no antinomy to reason, even if it cannot, of course, be clearly imagined.

The real problem connected with pure space arises from its unique quality of a nothingness that evidently has a constant and measurable expansion, as contended by astronomers and mathematicians. This problem is hardly solved by following in the wake of certain modern physicists, who, in desperation over the difficulties connected with the hypothetical ether, have proposed to make space itself semimaterial. I need only mention Aloys Müller in his *Das Problem des absoluten Raumes.*

If space itself is semimaterial, possessing qualities which account for gravitation and for the propagation of light, then this state of things would be equivalent to an infinite space, everywhere filled with on the whole immovable ether. The difference would be merely one of terminology. This semimaterial space would have to possess the faculty of partial movement or vibration. But our reason balks at the idea of such a space, which runs up against the definition given by an authority like New-

ton.[2] From the standpoint of logical thought it would seem much more reasonable to dispense entirely with a medium for gravitation and the propagation of light, making the former a force inherent in the material bodies, which can act through vacuum, and the light a corpuscular entity propagated through empty space. If I am not mistaken, both possibilities have really come to the front again recently among physicists. This is, however, a matter that must be decided by them, and the venerable ether hypothesis seems still able to line up such a formidable following that the philosophers seem justified in holding on to it for the time being.

But if this ether exists, must it therefore necessarily be infinite? Might it not share with material things the fate of being potentially measurable and finite?

Scientific men of high repute, like Büchner, Haeckel, and Arrhenius, have held the theory that the material universe, including the ether, must be infinite in extension and fill space everywhere, and some of them have given what they considered conclusive arguments for this belief. Thus Büchner contends that the material world, if it had limits. would rush together in one solid lump on account of the force of gravitation. Professor Arrhenius, on the other hand, in his *Worlds in the Making*, holds that the matter of an originally finite world in the course of infinite time would have been radiated and expelled into infinite space, leaving no stars and planets. These are the only important arguments that I have seen advanced by physicists. But since they are contradictory, might it not be that they both taken together explain the situation? What prevents the radiation into space is exactly this fact of gravitation, as suggested by Prof. R. W. Sellars and others, and gravitation is counterbalanced in its turn by the radiating and

[2] "Absolute space in its own nature, without relation to anything external remains always similar and immovable."

expansive forces in nature, even if that nature is limited. Any piece of matter is now generally supposed to have empty spaces inside of it, even at the core of a globe, and there is no more reason for doubting that there are forces active to keep the suns and planets apart, even if there is an end to their number and distribution in space.

As regards the argument of Professor Arrhenius, it would clearly fall to the ground if we could make it plausible that even the ether is an existing quantity, i. e., not infinite. For in that case there could be no radiation beyond the ether ocean, on the present theory of light.

The difficulty connected with the idea of an infinite material world or even an endless ether ocean is, as held by some of the acutest philosophers, that existing things must necessarily be of a definite number or quantity. According to Dühring, "everything posited as actually given in terms of number can only exist in a definite quantity." According to Riehl, "the sense-world has spatial greatness (i. e., is finite as to mass) though perhaps no definite limits in space.... The world never had a beginning. It has no limits in time." Prof. J. S. Mackenzie (*Elements of Constructive Philosophy*, pp. 208, 412) says: "Apart from any metaphysical theories, there appear to be physical grounds for regarding the material universe as a limited system," while "intensity and extension are infinite orders," and "side-by-sideness regarded simply as an external order seems clearly to be infinite."

On the other hand, Kant, according to Fr. Paulsen, really seems to have believed that matter is the movable which fills all space, there being no such thing as empty space. This would agree with his well-known proof of the antithesis of the first antinomy: "The world has no beginning and no limits in space." Assuming the opposite: "In that case the world would exist in an empty space without limits. We should therefore have not only a rela-

tion of things *in space* but also of things to space. As, however, the world is an absolute whole outside of which no object of intuition and therefore no correlate of the world can be found, the relation of the world to empty space would be a relation of no object. Such a relation, and the limitation of the world by empty space is nothing, and therefore the world is not limited with regard to space, that is, it is infinite."

The only excuse for this shallow reasoning seems to be the old Aristotelian idea of space "as the immovable limit of whatever is moved," a remnant of the naive conception of space as a vessel that contains the world inside of a firmament. Kant realized the weakness of this theory and saw that empty space cannot set any limits. But his fallacy was the conclusion, that this implied a world of appearance as endless as space itself, and a relation of the world to nothing. For what prevents us from saying that the extended world sets its own limits? And the relation of matter to apparently empty space is one of the most familiar experiences of our daily life. A logical quibble can generally be overcome by a simple verbal substitution.

The question is still before us, whether the invisible ether may not fill all space. But as far as logic and conceptual thought is concerned, the idea of a world of planets and suns and stars and an ether ocean that are limited in number and quantity, would seem to be much better founded than the opposite assumption. I cannot, on the other hand, with Riehl speak thus lightly of Kant's proof for a limited world: "An infinite aggregate of real things cannot be regarded as a given whole, nor therefore as given at the same time." This reasoning follows the proper definition of a "whole," and it is in line with that of the above philosophers.

If we scrutinize this idea closely and succeed in keeping our mental poise in front of the mystic and mysterious in-

finite, it seems self-evident that what exists at a given instant as a material or semimaterial entity, cannot be infinite as to number and quantity, not to mention the contradiction of an infinite "whole." The changing number of planets and stars and nebula cannot exceed any figure that might be written down on paper, for it is the nature of figures to be potentially greater than anything which is, so to speak, lifted out of the ocean of non-being. The astronomers guess at from fifty to several hundred millions of stars and a universe so vast that it would take light, which speeds along at the rate of ca. 186,000 miles per second, all the way from 3000 to 30,000 years to traverse the expanse. But even if the number of dead stars and planets should, as some of them guess, exceed the above figure, this would not even be a fraction of infinity.

And when certain philosophers have tried to make an exception for the ether on the ground that it may not be a compound of single parts, I should think this assumption can be proved to be unwarranted.

The ether must, if it is of any use for science and the world, be a very real thing that can act and be acted upon. It must be an existing something, and it is unthinkable that it should not exist in a given quantity at any given time. But the same reasoning does not apply to the non-being, the vacuum which is pure space.

An infinite object can, of course, not be pictured by the inner eye, and our imagination persistently clings to the concave firmament above us as the prototype of a real space boundary somewhere. But if we succeed in holding on to the idea that there can absolutely nowhere be less than the vacuum which is empty space, and that the existing universe, or universes, including the ether, necessarily must be finite, the difficulty assumes a less formidable aspect.[3]

[3] Since this was first written, I was gratified to read in *Astronomy of*

We see the sidereal universe strung out in its immensity, not as lamps in a fixed, concave firmament, but as tremendous balloons moving along in and with the vast ether ocean, which may stretch out for billions of miles in every direction outside of the system of stars. This ocean is to the world of stars and planets what the atmosphere is to the earth, and we have no difficulty in imagining the entire system in a majestic procession from eternity to eternity, since there is absolutely nothing to retard its course.

To use a personification, the infinite vacuum which is empty space willingly opens its doors to welcome it, and patiently remains in its solitude, when the tremendous procession has finally passed with all its noise and bustle, its joys and its sorrows, its struggling heapful of truths and its mountains of misconceptions and ignorance, a wonderful world of mysteries, bravely accepting the fact of its own existence and ceaselessly striving to solve its own riddle.

The universe may not proceed in a straight course.[4] Considerations connected with non-Euclidean geometry make it conceivable that we have to do with an irregular eliptic orbit, partly caused by the internal arrangement of the "wheels," the rotating stars and planets. But the important fact is that it moves on in its entirety, for this general, absolute movement is bound to have some significance for the self-created movement of its greater and smaller parts, the march of the suns as well as the play of the electrons, the very condition of its existence as a visible, active world.

To-day, by Dr. C. G. Dolmage, that the idea of a finite ether ocean, enclosing a rounded finite universe like an atmosphere, was suggested by Mr. G. E. Gore already in 1888.

[4] I understand that certain astronomers speak of two star streams that seem to proceed in somewhat different directions. But this may only mean that a smaller universe has mingled with the main current so that the general direction of the whole will in the course of time again be one. Or might it not be that the entire universe is slowly revolving around an axis, as it moves forward?

The much-disputed question of the relativity or absoluteness of space would on this theory have found its solution. Absolute space is, according to Aloys Müller, a space which permits absolute movement, and our moving sidereal universe would be just such an absolutely moving body. This does, of course, not do away with all kinds of relative movements inside of the sidereal system, the only movements furthermore which can be measured by human beings.

It is frequently contended that only science can settle the question of the extent of the universe, and that it is not yet capable of venturing an answer. That may be so. Yet human reason counts for something, and it seems unhesitatingly to demand a finite world or worlds. The probability or non-probability of more than one sidereal universe can hardly be vouched for by either. Such worlds would have absolutely no means of communication if the propagation of light requires a medium and if this medium, as here contended, does not pervade space everywhere.

It can hardly be argued that through infinite time, whatever existing things there are, must have had a chance to collide or somehow get together into one system or cosmos. For the pure expansion, the non-being which is empty space, is also posited as infinite.

But those who are more apt to ponder the misery, the meanness, the ugliness, the disharmony and falsehood, than the happiness, the goodness, the beauty, the harmony and truth, which our one sidereal universe contains, and probably will go on containing during its eternal partial evolution and dissolution, from nebula to stars and planets and back again to nebula, may find some reason for pinning their faith in a new article of religious belief: that the universe is after all only a single limited cosmos, and that frail, disharmonious, suffering beings like ourselves may not be found on very many of its numerous planets.

The primitive conception of the world was naturally too narrow in every race and tribe. Our little earth was considered the center and fixed base of everything there is, and human beings counted for something in the make-up of the universe. Recent speculations have generally gone to the opposite extreme, making old Tellus only an insignificant speck in an infinite abyss of stars and habitable planets.

While the idea of an infinite creation ought to be foreign and even repugnant to a theistic mind, those of a pantheistic tendency have perhaps justly feared that the awe and mystery so necessary to religious feeling, would suffer a serious loss if one had to conceive the universe, the outward expression of Divinity, as a finite thing.

But for the fearless and sober investigators of the world riddle, for those who are continually striving to get ever nearer to the unknown x of the world equation, it is, I should think, of some importance to get rid of the hazy and mystic verbiage connected with the discussions of the infinite, in order to be able to concentrate attention on immediate and more fruitful problems. And our one sidereal universe is surely wonderful enough and big enough to keep poor groping humanity busy for ages and ages to come.

JUUL DIESERUD.

WASHINGTON, D. C.

THE NEW NUMBER OF THE COSMIC SAND.[1]

ON THE EXTENT OF THE UNIVERSE AND THE LIMITS OF SPACE AND TIME.

ARCHIMEDES, one of the most original thinkers of antiquity, in a letter to Gelo, a son of King Hiero of Syracuse, discusses the curious question of the size of the universe. The title of his treatise reads: "On the Number of the Sand, or the Vastness of the Universe."

Calculations which are simply amazing when we take into consideration the general knowledge of the period brought Archimedes to a number for the aggregate of the smallest particles in the celestial globe (called sand) for whose expression it was necessary to invent new numerals. The following lines may perhaps serve to lift the hitherto impenetrable veil which has covered the motives of this document of Archimedes.

The sentence, *Quod non est in sensu non est in mundo* ("What does not exist in human consciousness [*Bewusstsein*] does not exist in the universe"), can be correctly understood only when we keep clearly in mind that there are three stages of human consciousness: There are sensations [*Empfindungen*]; there are concrete images [*Vorstellungen*[2]]; and there are concepts [*Begriffe*]. In these

[1] Translated for *The Monist* from the German manuscript by Lydia G. Robinson.

[2] The word *Vorstellung* is very difficult to render properly into English. Perhaps it is most often translated by "idea" or "presentation"; but "idea" is too often used (as formerly by Locke) to cover practically any content of consciousness even including all three of the stages here mentioned, and "presentation" rather denotes an object as it is cognized at any given moment of

three instances the words "there are" [*es gibt*] have such different meanings that a large part of all differences of opinion in religion and philosophy can be referred to the different usage of the words, "there are (or exist)." All human beings possess the same mode of drawing conclusions logically. Differences of opinion arise either from lack of agreement in regard to the premises, or from the different use of exactly the same words, especially the words "there are."[3] The conflict of minds is at the same time a conflict of words.

There are sensations. This reality not only does not require proof but is not even susceptible of proof, for none but our own sensations possess this certainty of reality. Sensations of other living beings are always inferred from motions by analogy with our own sensations. There are no sensations of other living beings in the sense that there are sensations of our own, but for these two very different realities our language possesses only the one expression, "there are."

The case is even worse with the content of our third stage of consciousness—ideal constructions or concepts [*Begriffe*]. Here we need only consider the controversies and proofs for and against the existence of God, and the dreadful tribulations which the want of understanding regarding the existence of concepts or ideal constructions has brought upon unnumbered people, in order to show the importance of the demonstrability of a content of consciousness. Again, there is freedom, or there is beauty, in quite a different sense from that in which we can say there are eyes or ears, and to endeavor to prove the existence of a concept, rather

the perceptual process implying relation to a present object, which *Vorstellung* does not. Whereas the meaning of *Vorstellungen* may include three kinds of images, perceptual images, memory images, and imagined images, here—in its limitation to the second stage of consciousness—I follow Professors Tufts and Mead in defining it as "concrete images with their meanings."—TR.

[3] Misunderstandings which, as frequently happens, arise from malice and the intention to hold up to contempt those who differ from us belong to the category of wasted energy.

than its applicability, is merely to display one's own want of understanding. The world of concepts lacks proof for the existence of its content as does the world of sensations, for proof belongs to the world of concrete images in their reference to human sense-impressions.

Our world, or reality, consists of those parts of consciousness which are at all times connected with human sensations, or can be regarded as so connected. We cannot prove directly that the stars actually exist because we cannot apply other sense-organs to corroborate the testimony of the eye. It is nevertheless enough for each person to believe that he would feel the heat of the stars if he came near enough to them, for him to believe that they really exist, instead of assuming that he is merely the victim of an optical illusion. We regard it as a further proof of the actual existence of the stars that we can predict by calculation what our eyes perceive and also the impressions recorded on photographic plates, observing that the predicted sensation and the sensation actually experienced agree closely, with but rare exceptions.

The world of concrete images, reality, is not only characterized by the fact that its parts can always be brought into direct connection with sense-impressions, but also by its constant capacity for relation with measure and number. Nothing in the world of reality is infinitely great or infinitely small; everything is circumscribed numerically. To count means to recall sensations. It is not the objects of the external world (as we call the computable part of the world of our consciousness) but our sensations that we count. Therefore it is only concrete images that can be counted and not concepts or ideal constructions, for they cannot be thought of as directly connected with sensations. The questions, how much soul, how much beauty, how much freedom there is, are inadmissible; on the other hand we can and must count concrete images.

Because concepts develop very gradually from concrete images in our consciousness as concrete images combine into larger unities, frequently without receiving any new appellations, the same word can easily denote either a concrete image or a concept.

A source (spring) in the mountains is a concrete image; a source meaning origin—for instance, the source of justice—is a concept. Again, a source in the historian's sense is a concrete image when he is designating a document as a source. The criterion is always whether or not we can connect the word in its intended acceptation with a sense-impression, or can think of it as so connected. If not we cannot count. The sources of a historical work can be counted, but not the sources of justice or religion. That our stages of consciousness have stages of transition which prove very troublesome in a discussion makes that discussion difficult even where there is the best intention on both sides to understand each other; just as the poverty of human language can only gradually meet the increasing demands made by the constant formation of new concepts by constructing new words.

If we ask about the extent of space and time, or, as many express it, the infinity of space and the eternity of time, we shall have to determine first of all whether space and time belong to concrete images or to concepts, or whether these words are after all used for both images and concepts. The last is the actual state of things. Space and time are directly connected with sense-impressions and depend on them. It is only by sense-impressions that we have a concrete image of space and time; therefore there can be no doubt that the words "space" and "time" belong to the second stage of consciousness, which is at all times connected with sense-impressions or can be regarded as so connected. By remembering the regular sequence of sense-impressions in motions we gradually construct our

concrete images of our spatial world, the world of motive processes which give rise to sense-impressions. A single sense-organ cannot originate any spatial image; not until we have a combination of impressions of several senses is there produced in us the concrete image of a spatial world. Our so-called sense-organs, the eyes, ears, tongue, etc., contain many primitive sense-organs combined into a higher unity. Time, on the other hand, is a concrete image of a succession of sensations. A single sense-organ would suffice to provide us with a concrete image of time presupposing but one series of sensations and memory. Hence our concrete images of space and time involve a succession of sensations. The moment we drop human sensation space and time vanish as forms of our concrete images.

But space and time have not simply remained concrete images; they have developed farther into concepts which can no longer be thought of as connected with human sensation. We speak of four-dimensional and multi-dimensional spaces which have nothing in common with our concrete image of space but the word "space," without the slightest connection with human sense-impressions; we have within us a concept of time which is thought of as independent of the imageable course of human sensations. It is in this sense that man constructs also the unreal concept of eternity. Hence, there are concrete images of space and time that can and must be limited numerically, and there are the unlimited concepts of space and time which have nothing to do with numbers and therefore cannot count as actual existences in the world. We speak of actual existence only with regard to concrete images, leaving out of account the reality of sensations. We cannot ascribe actual existence to concepts, because by the word "actual" we mark the boundaries of the world of concrete images from all the surrounding world. Hence the question of

the extent of the universe changes into that of the limitation of our concrete images of space and time.

In the world of concrete images—the world of concrete motor images, our world—there is nothing, as we have said before, that can be said to be infinitely small or infinitely great; everything is numerically circumscribed. How vast, then, is the extent of the starry universe which, without our will, leads us beyond the world of concrete images into the world of concepts and suggests to us the concepts of infinity and eternity? The question of the distance of the nearest stars was long since solved; the question of the distances of the farthest stars whose light will ever reach a human sense-organ is solved when we can estimate the transparency of the cosmic ether, which like everything else in the universe we know cannot be infinitely great.

Besides the hypothetical ether, interstellar space also contains multitudes of fine particles of matter—cosmic dust—which put a limit to our vision and construct a measurable celestial orb, just as atmospheric dust causes a blue dome to appear to surround us in the daytime. We must ask how far away a star, i. e., an illuminating body of approximately the dimensions of our own sun, must be for no perceptible ray of light to be able to reach our eyes. We possess a point of departure for the appreciation of this distance in the decrease in the number of visible stars beginning with a definite order of magnitude. If space were absolutely transparent to us the number of stars would increase the more (other things being equal) the less the intensity of their light appeared to us; generally speaking, the stars farthest away would give the weakest light. In fact, the number of stars does increase with the increased power of our optical instruments to stars of the eleventh magnitude, but then the number of stars giving a still feebler light decreases instead of increasing, as an indication of

the obstruction of light in so-called empty space. Even were we to imagine all cosmic dust, all dark bodies, as absent from space, still we could not assume that the space between two stars is absolutely transparent—for we know there is nothing absolute in the physical world. By the amount of the obstruction of light in space the size of the space of our universe is determined; and this space is smaller than a sphere with a radius of 10^{30} centimeters according to the calculations of astronomers, who estimate a radius of 10^{21} cm. Therefore we are the better able to say that a sphere with a radius of 10^{100} cm is much greater than all the starry universe that will ever come into consideration for concrete human representation. An extension of our concrete images of space would only be conceivable if we could ascribe to the man of the future the ability to travel the distance of such a celestial orb, or more than 10^{70} cm from the earth. Leaving this out of the question, the imageable world-space is less than 10^{300} cubic centimeters.

The size of our universe to our imagination rests not only on the size of the space which a glimpse of the starry universe enables us to divine, but in spite of the poverty and limitation of our consciousness we can conjecture an unexhausted and inexhaustible abundance of multiplicity in cosmic events. In this respect also far narrower limits are placed to human imagination than we have hitherto suspected. With the finiteness of space the finiteness of time is indissolubly connected by the limitation of possible multiplicities. The more elements the world of concrete images in human consciousness is composed of the richer it is, but the human mind cannot do more than take these elements in turn. If the number of elements is not infinite then after a certain period the same sequence of cosmic events must recur. Nietzsche's theory of eternal rebirth finds its unshakable mathematical foundation in the finiteness of

our actual space. The number of multiplicities which determine our world of concrete images is immeasurably smaller than the number of the smallest elements which can be thought of as connected with our senses when we think of our space as filled up with such elements. The question of the number and kind of the elements of our concrete images which actually exist will in the near future be seen to be one of the most important questions of the science of man.

The smallest elements that we can image as connected with a human sense-impression are those whose dimensions are not altogether too far removed from the dimensions of light-waves. On the basis of physical experiments we can assume that particles of 10^{-27} cm diameter cannot produce any sort of disturbances of light-waves. The smallest particles of the physicists have a diameter of about 10^{-8} cm. Small particles with a diameter of only 10^{-25} cm could not influence a human sense-impression to any extent. Their presence cannot be concretely imaged but only conceived. The number of such smallest particles in concretely imageable space, *the new number of cosmic sand*, would therefore amount to far less than 10^{100} $10^{-47} = 10^{153}$, while the old number of the sand computed by Archimedes would be 10^{64} when translated into our own numerals.

Although the new cosmic number is inconceivably greater in numerical value than that of Archimedes, yet in category it is not superior to his ancient number. To perceive a larger number of decimal places we do not require a new kind of multiplicity. Not until we calculate the duration of time from the new cosmic number are we led beyond the thought of Archimedes to new numerical categories for which we are obliged to invent new numerical terms.

Counting is an abbreviated recollection of a sequence of touch-impressions. The broader the range of our knowl-

edge becomes, the greater will be the numbers with which we deal. The world war of 1914 with the enormous enrichment of the content of knowledge that it affords humanity has brought to civilized mankind an extraordinary increase of those numerical quantities which must be taken into consideration. Before the war the limit of the imagination of average humanity did not extend beyond millions. Now milliards[4] occupy the place of the former millions. When we realize that there are tribes whose numerals end with 20 (hands and feet) we shall not wonder that there arises from time to time a need for the expansion of numerical systems. A new larger numeral means greater facility in counting and in communicating large numbers to our fellow men. Since the value expressed by 10,000 (μύριοι) was, generally speaking, the highest numeral the Greeks were familiar with, Archimedes, in order to be able to express his "number of the sand" created new numerical periods by multiplying 10,000 by itself. The index of the last period which could be formed in this way would be 10^4. Our present numerals form a series whose last easily pronounceable number with 600 places we would call a centillion. Higher numbers can be pronounced only with great loss of time. A million times a million is called a billion, and so on up to a centillion which is a million multiplied by itself one hundred times. A million is 10^6, a centillion therefore 10^{600}. We form our large numerals by multiplying by a thousand. A million is a thousand times a thousand. Our new cosmic sand number, which

[4] Though many scientific people in the United States have for some time been used to the term "billion" as denoting millions of millions, and "trillion" for a million of billions as is the common meaning of these terms in Europe, still the popular comprehension and general usage here has continued to employ "billions" for thousands of millions and "trillions" for thousands of these billions, etc. Mr. Friedenthal's exposition incidentally gives a forceful argument for entirely abandoning this popular traditional usage in our newspapers and elementary text-books in order that we may keep abreast with the line of inevitable progress of scientific knowledge. Beyond the hundred millions we can then speak of thousands of millions or join the English and Germans in adopting the French term *milliard*.—Tr.

we have placed at 10^{360}, though greater than the number of the smallest particles in our whole world of concrete images, is therefore much smaller than a centillion.

Instead of multiplying our numbers as Archimedes did we will raise them to higher powers, and to name the number raised to a power as great as itself we will use the suffix *-iode*; thus a million raised to the millionth power will be a *milliode*, and the largest number thus conveniently pronounceable (a centillion raised to the centillionth power) a *centilliode*. In figures we write a milliode $1{,}000{,}000^{1000000}$ or $10^{6(10^6)}$, a centilliode $10^{600(10^{600})}$. The number of variations of n elements is the iode of n, or n^n. The iode of our new cosmic number, $10^{360(10^{360})}$, is greater than all the multiplicity of events in our actual world, but if we want to form a larger numeral than a centilliode we can call a number n raised to the n^nth power an *iodade*. The iodades are also interesting from a technically numerical point of view, because they represent the highest series which can be formed with three identical numbers as the only elements. Hence we have the iode series 1^1, 2^2, 3^3, 4^4, to n^n, and the iodade series $1^{(1^1)}$, $2^{(2^2)}$, $3^{(3^3)}$, $4^{(4^4)}$, to $n^{(n^n)}$.

Of this second series of powers we can assert that no human imagination can make requirements which cannot be easily satisfied in the world of concrete images within this series. The largest number that is easily pronounced would be a centillion multiplied a centilliode times by itself, to be called a *centilliodade*.

The next higher series of powers would contain those numbers in which the base is raised to the power of its iodade, or $n[n^{(n^n)}]$. It would be entirely superfluous to give names to this series and those that follow. Mankind will scarcely be required to form new numerals to represent larger numbers than the new iode and iodade numerals.

In order to pass from the infinity of space to the infinity of time we shall take for our minimum unit of time the

period required for a tiny particle with a diameter of 10^{-20} cm moving with a velocity of 10^{6} (a million) kilometers [$= 10^{11}$ cm] per second to pass in a straight line the length of its own thickness, i. e., in order to exchange places with the particle next to it. We have the equation $t = s/v$, in which the time is equal to the path divided by the velocity. This gives $10^{-20}/10^{+11}$, or $t = 10^{-31}$ seconds. Although this particle of time may be too small with respect to imageable particles of time, yet, on the other hand, the new cosmic number is so much greater than all imaginable possibilities that the period of time which is calculated from the variation of the cosmic number up to the exhaustion of all variations is computed as far too great with respect to the imageable duration of time. If we multiply the multiplicity of the universe by the minimum unit of time we arrive at the formula $(n^n)t = 10^{360(10^{360})}$ seconds. In this formula we can neglect t without virtual inaccuracy. According to this formula it is practically of no consequence how long we regard the time up to the completed change of the world-aspect, i. e., from one variation to another. *The greatest duration of time imaginable is in every case very much smaller than the iode of the new cosmic sand number.* Yet before the expiration of this period a world-aspect must return which has been present before. Man will regard the same course of further processes as inevitably connected with this recurrence of the same situation, since we assume that the whole future is necessarily conditioned by the arrangement of the smallest particles in one definite moment of time.

It must be granted that owing to the distinctions of right and left in space and of forward and back in time one arrangement (or variation) of the smallest particles does not strictly determine the course of all future time. We may conceive of an arrangement in space reversed like a mirrored reflection but otherwise the same, and of a

sequence of events in time that is retrogressive but otherwise the same. Both of these exceptions must be ignored in interpreting the above rule.

But even if we would regard all the variations of the world-aspect as entirely independent of each other, i. e., if we regard mere chance as the decisive factor in determining the series of variations, by the aid of the calculus of probabilities we must still inevitably infer a limited duration of imageable time from a limitation of imageable space. Of course the probability that in the accidental sequence of the variation of many elements not only does one situation repeat itself but the whole sequence is repeated, is slight but by no means infinitely small.

The probability that all n^n variations of n elements will be repeated in the same sequence, in spite of absolute independence of each other, is the reciprocal of the iodade of n, hence $1/n^{(n^n)}$. If we construct the iodade of our new cosmic number we shall obtain a numeral for a period of time that is greater than the probability of the whole sequence of cosmic events repeating itself in the same way, without any interdependence of variations. The expected time will therefore be much shorter than the period calculated as passing between one recurrence and the next, shorter than $10^{360}[10^{360}(10^{\infty})]$ seconds.

The following speculation may enable us to form a faint notion of the length of this period of time. There is a German fairy-tale in which the following answer is given to an inquiry as to the duration of eternity: Within a forest stands a mountain of purest diamond one mile long, one mile wide, and one mile high. Every thousand years a little bird comes, sings a song, and whets his bill against the diamond mountain. When the whole mountain has thus been whetted away so that nothing at all is left of it then the first second of eternity has passed. A simple calculation shows that there is no comparison between this

second of eternity and the iodade of the new cosmic number, not even with the cosmic number itself, 10^{360}. We must assume that at least one molecule of the diamond is lost in the process of whetting, otherwise nothing at all would be lost—which is impossible. A mountain a cubic mile in size does not contain as many as 10^{40} molecules (there are more than 10^{24} in a liter).[5] A thousand years contain a little more than 3×10^9 seconds. We need only multiply the number of seconds by the number of molecules to obtain a length of 10^{50} seconds, or about an octillion,[6] for this second of eternity. Even the cosmic number of Archimedes was therefore incomparably greater than the time which would actually pass in completing the whetting away of the diamond mountain. Of course it is clear that with friction a diamond would really wear away a much larger mass than the size of a molecule.

On the other hand, the iodade of the new cosmic number 10^{360} might very well claim to be regarded as the second of eternity since all the time the greatest human imagination can conceive is as nothing to this number, and no problem exists which the imagination of a naturalist of the present or future can propose, whose solution in numbers will not be very much smaller than the iodade of the new number of the cosmic sand.

Sunt certi denique fines, holds true of all events within our conceptions of space and time. Whoever is inclined to presumption, let him estimate the numbers of the different variable concrete elements within his own consciousness and compare their iodade with that of the new number of the cosmic sand.

HANS FRIEDENTHAL.

[5] [In fact less than one twentieth that many, although of course German miles are thought of: $1\,m^3 = 10^3\,l$; $1\,km^3 = 10^9\,m^3 = 10^{12}\,l$; 1 cubic mile $= (7.5\,km)^3 = 421.875 \times 10^{12}\,l = 421.875 \times 10^{36}$, i. e., less than half 10^{39}, molecules.—ED.]

[6] [To use the (approximate) values of note 5: $422 \times 10^{36} \times 3 \times 10^9 = 1266 \times 10^{45} = 1.3 \times 10^{48}$ seconds.—ED.]

THE TEXT OF ALCHEMY AND THE SONGE-VERD.

INTRODUCTION.

Le Texte d'Alchymie et le Songe-Verd deserves to be rendered accessible to English-speaking students of the history of science because it is a reflective and well-reasoned exposition of the doctrine of the three principles (Sulphur, Mercury, and Salt) which dominated in one or another of its forms all knowledge of natural science from most primitive times up to the time of Robert Boyle and the rise of modern chemistry. As such treatises go, it is a remarkably clear exposition. Its interest is heightened by the fact that it is devoted entirely to a discussion of the theoretical aspects of the doctrine. Its author describes none of his own experiments, but expounds the doctrine in such manner that its devotees may make use of it for the elucidation of their own. Given the alchemist's description of his experiments, it is not always easy to deduce his doctrine; but, when his doctrine is given, his jargon quickly becomes intelligible.

Psychologists affirm that young children understand the meaning of *Yes* long before they have grown to any understanding of the meaning of *No*. If an object pleases them, they make a movement toward it, articulate a crude sound of affirmation, or in some other way indicate *Yes*. But for a time, if an object fails to arouse a yes-response from them, it meets only with an indifference, with a simple failure to be recognized; and it is only later in their development that it comes to meet with a definite aversion and *No*. Possibly this perception of the difference between Yes and No is the most important step in the growing acquaintance of the child with the natural subjective and objective world which lies before him for his observation. In the same way the beginnings of human knowledge are rooted in the observation of the contrary qualities

of things. Primitive minds were intrigued by the difference between positive and negative, active and passive, hot and cold, wet and dry, alive and dead, light and dark, etc. The first philosophy seems to have been that which pointed out, for every pair of opposites, the existence of a *third* in which the conflicting two were somehow summarized, reconciled, and restored to equilibrium. And primitive science consisted in the study of analogies, of similarities between pairs of contraries, and of reconciliations.

The study of opposites, by the artifice of assigning numbers to its terms, one for the positive, two for the negative, and three for the higher unity in which these two were embraced, by the observation that the unity designated by three was itself of a distinctly positive or negative character, and by the construction of still higher unities, led, long before Pythagoras, to the "Pythagorean" symbolism of numbers. Four, being the first number of the second set of triads, was the number which applied to the qualities of objects, and there were four elements and four temperaments. Because seven was the first number of the third (and first reconciling) set of triads the Babylonian priesthood found it convenient to distinguish seven principal heavenly bodies and to assign a deity to each —and bequeathed to future time the lore of the seven metals, etc., and determined for the twentieth century that we have seven days in the week. The study of opposites, developed into the symbolism of numbers, determined that the hour should be divided into sixty minutes and decided that ten was the only suitable number for the Commandments. In the brains of modern thinkers, the study of opposites has led to such things as Hegel's thesis, antithesis, and higher synthesis doctrine, to the Doctrine of Interpretation of Royce, and to his Great Community. Indeed, philosophy and science seem each to have had their beginning in observations of opposites and similarities, of conflicts and reconciliations.

The study of opposites led early to the habit of describing abstractly all natural objects in terms of the four qualities—hot, cold, wet, and dry. Any two of the four terms constituting these two pairs of opposites could be applied to the description of things; Fire was hot and dry, Earth was dry and cold, Water was cold and wet, and Air was moist and warm. All things were regarded as compounded of various proportions of these abstract elements (or embodiments of qualities), Fire, Earth, Water, and Air. The elements were not concrete things, actually present in objects, but

not inhabited, for it was environed about with darkness which covered the abysses; and the Spirit of God was borne upon the waters. God said, *Let there be light.*"

Whoever will understand thoroughly these words of Genesis will see that, since the beginning of the world, there has been one substance which can be known only if a light is made to dissipate the darkness which hides it from our eyes.

Man, not being able to make any substance for himself as he pleases (because it appertains only to God to make something out of nothing), can very well make a light for himself which will clarify his understanding for the discovery of the substance which is absolutely necessary to him for the accomplishment of his desires. But it is only through science that he can acquire this light; and it will not be without labor that he will acquire this science.

But, as he ought not to do anything without a purpose and a design, so ought he to seek all means to arrive at this end and to attain his desires. This being certain, the philosopher who directs his intentions toward the Philosophical Stone ought to seek the means to succeed in them. What are these means, if not first the knowledge of the substance—to handle it, and later to govern it and adapt it to his aim? Aristotle teaches us that the wise man must know not merely the things which come from principles but that he needs must have a knowledge of principles as well.

It is necessary, therefore, that those who know that the universal medicine is possible should know also the principles of it. And it is necessary that the philosopher should know the substance of the Philosophical Stone before beginning to undertake the search for it. But this true substance is a treasure so hidden that all the philosophers who have had it in their possession have made a great mystery of it, and, if they have written about it, they

have done so only in terms so obscure that it is well-nigh impossible to understand them. As for me who write without envy, I wish, my child, to make it known to you and to render it altogether sensible to you, provided you are ever so little a philosopher, and provided your intention is direct.

Come near, child of science; come and imbibe from me the treasure of that wisdom which contains the true substance of the Stone of the Sages. Learn, first, that our substance is not to be sought in that universal spirit which is contained in all that has been created. It is impossible for mortals to attain a point so elevated; and many err grossly who imagine that it is possible to reap for themselves a portion of this universal spirit which, containing all things, is not determined by anything in particular.

I have, however, seen persons, apparently of good sense, give themselves over to these imaginations. In times of heavy dew, they exposed to the air a conical glass vessel at the bottom of which there was a dry substance, previously dried and altered; and this was done in such manner, that, after a space of five or six hours, they found in their vessel some drops of water which this substance had attracted to itself. They evaporated this water in the sunlight, and there was left a red or reddish earth which they imagined to be the true incombustible Sulphur of the Philosophers or their male Mercury. But it was nothing else but the freer earthy parts of exhalations cooked up and dried by the heat of the sun, which, being sustained in the air by the vapors which opposed their fall, finally fell when these vapors fell: and this is justified by the fact that it was along with water that this powder was brought into the vessel.

There is no need to go so far to seek our substance. Reflect upon the uses to which it must be turned. These are, you say, to prepare the Philosophical Stone? This

You, then, who, being a lover of wisdom, wish to become perfectly wise, comport yourself with moderation in searching for the Stone of the Sages. Surely you already have some glimmering of this wisdom to which you aspire for the cognizance of our substance. Our substance is not a conversion of elements, for the elements cannot be truly converted from one into another nor can they change among themselves wholly—even though Aristotle does teach us that, if the heat in the air is superseded by the cold in it, water will be produced, because air is warm and wet, while water is cool and wet, and so, the heat being neutralized, water is formed. But this great philosopher did not teach that this apparent change is a real transmutation of elements, since it is very certain that the material which appears to change from air into water is by no means air but is water volatilized by the heat of the sun.

It is absolutely impossible to believe that cold can be changed to heat and heat to cold. And we must believe that the philosophers have talked about the elements of which the various substances are composed because in that way they could make known the qualities of the substances more clearly. It was in this sense that Hippocrates said, "Although the four elements, and especially Water and Fire, enter in the same amount into the composition of the body of man, the soul is very wise and provided with an excellent memory, but if the amount of Water exceed the amount of Fire, it becomes stupid and doltish."

Hippocrates, in speaking so, did not claim that a man can be made up out of a just proportion of the elements, but his design was to teach us that a man, to be of a praiseworthy disposition, and not to manifest any of the dominant passions which are contrary to wisdom, ought to be of a nature in the composition of which the elements, that is to say, the four qualities of cold, hot, dry, and wet, are equally concurrent.

To return, then, to our substance. It is very certain that it ought not to be sought in the universal spirit. Surely it is there, but art certainly cannot extract it. It is of the same material as the four elements, and, moreover, from them also it cannot be extracted.

Do not, therefore, break your head in making a thousand useless tests, such as sublimations, mortifications, putrefactions, solutions, digestions, calcinations, distillations, and so many others. And do not follow to the letter the passage of Aristotle that "chemists will never be able to change the form of the metals unless they reduce them to their first principle." That passage is very true, but I assure you that you ought never to attempt this reduction of the metals to their first principle, because it cannot be done except by means of the true solvent.

For this solvent is an agent which, being of a metallic nature, opens the bowels of the metal and penetrates it without breaking it up into all of its parts, and, finding our primary substance, it can make it perfect and convert it into pure gold, without acting upon the impure and foreign matters which are present, but rejecting them like useless and superfluous excrement.

It is, then, very evident that the substance of the Philosophers' Stone is of a purely metallic nature and, by this token, it ought not to be sought in subjects so distant as the universal spirit or the elements. And this substance can no more be extracted from any metal, although it is contained in the metal as in a strait and very strong prison.

There is no key except the great solvent which can open the metal and make our substance available; and whoever shall have this solvent shall have the entire matter in his hands without the need of any other substance. So it is that the great Hermes taught when he said that our substance is hidden in golden caskets.

To extract it, then, from a metal it would be necessary

to destroy the metal in all of its most simple and most delicate parts, a thing which is absolutely impossible, for these parts, being determined as matter, cannot assume any other form. There is need therefore to seek the means of having so perfect a knowledge of this substance that it will be possible to find it; and it is this that I will teach, with the help of the Lord, in the second part which follows.

End of the First Part.

SECOND PART.

How the true substance of the Stone can be known: Concerning the manner in which it must be sought, together with the infallible means of finding it ready prepared for use in the great work.

It would not be necessary to be a philosopher to understand our substance if it were really distinct, even though it were placed among all the different substances that nature uses for her different works; for it is so beautiful, so noble, so simple, so rare, and so perfect that if it existed by itself alone it would make itself to be distinguished by the grossest ignoramus. But it is not to be supposed that nature has produced it for us all naked and in the simplicity requisite for use in the great work—for it is absolutely impossible to render this substance visible and palpable if one does not already possess it by means of science. It is useless therefore to seek by experiments to find the science of which one must needs know the theory before being able to use the practice.

Consider nature well (says a great philosopher), see how she forms the metals in the ore. It is in the ore, then, that the metallic substance ought to be sought, since it is only in this place that the metal which nature aims to produce is formed. Seek rather the means of finding it, if you do not know what hides it and in what it is enveloped.

For if this rich substance were so easy to find where it is, some among all the many workers who work continually in the mines would have been able to run across it. And, we never see any of these people (who are rustics and without wisdom) who have had the good fortune to make so beautiful a discovery.

But to have this knowledge, it is not at all necessary to go and penetrate into the earth even to its center. That would be useless. Spend your time in learning how nature works in all that is before the eyes; for it is not without reason that it is said, *Nature makes clever.* In this way, the depths of all things are sounded, and a man makes himself capable of understanding the philosophers.

But if you take the way of the books only, although this path may be very good, it is nevertheless not altogether sure. How many people have spent their entire life in reading all the good philosophers, who have nevertheless lost their time and have not reaped any fruit from it. If art perfections nature, we must also admit that nature serves as a model for art. If you have not examined how plants are produced, will you be able to understand Mary the Prophetess in these words (which are always intelligible)?—"To make the metals, nature uses only heat and dryness which overcome the cold and the moisture of the Mercury," or that other philosopher?, who says that "nature, in the mine, uses only one substance which is pure mercurial substance, and that this substance contains in itself the live and incombustible Sulphur which can accomplish our work alone without the intervention of any other material."

You will not be able to understand anything of these established verities as long as you do not conceive the manner in which nature makes use of heat and dryness to overcome the cold and the moisture. These operations, however, are taking place continually before your eyes, and yet you cannot see them in the vegetables. When you

shall understand what takes place on the earth, then you will be able to ransack it even to the center to seek there the origin and the substance of the metals—for then you will be able to read the philosophers with profit and utility, you will learn in a short time how the substance which is nearest to the metals is itself purely metallic (since it is by it alone that all the metals are formed) and that it is not determined as such by any other substance.

It may have happened that nature who strives always for the advancement of what she has once commenced, being turned aside from her path by some foreign cause, made unformed metals or minerals. For example, if a mine were entirely opened, metals not yet finished would be found there; and because the opening of the mine had interrupted the action of nature, the metals would remain imperfect and would never be fulfilled, and all the metallic seed contained in this mine would lose its force and its virtue in such wise that it would become thankless and sterile.

For without a formal obstacle this clever worker strives always to render her productions perfect. Thus we see that monsters are produced only because some obstacle interrupts the course of nature in her operations; for, without some accident which turns her from her ordinary path, she will always achieve her works and will never fail in that end. If we take nature for our guide (says Cicero) we shall not be misled. Follow her, then, in the conduct of your works, and let your purpose be to imitate her in your designs. Do not go faster than she, and be no slower also to perform. Neglect nothing that she uses, whether as an instrument or as a substance, for this wise artificer uses in her works only what is absolutely necessary for her to succeed in them.

If you wish to add any perfection to her productions (as may easily be done), imitate her and make use, to

arrive at your end, of the same means that she used to make the beginning. Examine then with care whence is formed the metals. I tell you truly that in that consists the entire work of the sages. For, to know the root of the metals, you must scour the entire class of metallic things, from its end to its origin, and from its origin to its perfection, and by this speculation you will learn all the operations that you must make in the great work; you will know the Fire and the origin as well as understand the substance.

When by your study and your labor you are sure of your substance, you will know forthwith the manner of seeking it. That is to say, you will not work in vain on the metals and on the mineral where it is so greatly involved that it can be extracted only with long labor and great trouble—and, even when extracted, this substance will not yet be pure enough to be used in the great work.

Seek, then, among the minerals a substance prepared by nature herself to compose the metal. This substance is still crude, and, lacking decoction, it is not congealed; and it is only by a decoction of the true substance that a separation of the world from the unworldly is made, of the pure from the impure, of the perfect from the imperfect. Aristotle teaches us again—that all things which are determined to be perfect and which have remained imperfect because of lack of digestion may be rendered perfect by a continual digestion.

This is very easy to believe. Surely it is of more value to cook and digest a crude substance to bring it to entire maturity than to separate it from a body in which it is engaged for a long coction and which has acquired all of the qualities necessary to give it the base and solid foundation of a metal. Do we not aid nature when we cover plants with manure in which is a vegetable virtue which gives nourishment to trees, advances the fruits, and secures

for them a prompt maturity? We see even that if fruits are picked while still green we can make them ripen by exposing them to the sun or by leaving them in a warm place, but we do not see that the cleverest gardener has yet been able to bring about that a fruit too advanced or too mature should resume its earlier freshness or lose anything of its maturity. This operation would be contrary to nature.

It is for this reason that people will never succeed in bringing about that change: for to antagonize nature is to undertake something that cannot be accomplished. Is there anything which more resembles the war the giants waged against the gods than fighting against nature? asks Cicero. So, my child, observe exactly this wise directress in all that she does. Follow her everywhere from the uppermost airs even to the abysses of the earth. You will learn unheard-of marvels. Yours will be the privilege to claim to be one of the children of wisdom, and to be adopted as a son by the great Hermes. You will be called like him Trismegistus, that is to say, three times mage, or three times great, for you will possess entirely the knowledge of the mineral, of the vegetable, and of the animal. Then it will appertain to you to write and to spread your science, for God does not wish that your light should be hidden under a bushel. It is a greater fault in a wise man not to write and so to fail to share his doctrine with those who can have need of it, than it is for those who, although they are only ignorant persons, write with a passion to pass for wise. You know what punishment befell the lazy Servant for not having made the best of the talents which the Lord had given him.

If, then, you have any true knowledge, you ought to share it and to loan it out that you may receive returns from it to the hundredfold and even to the infinite. Without profanation or irreverence for sacred things, I can apply to our subject these words which are wholly divine

—*Seek, and you shall find, knock, and the gate shall be opened unto you.* The great Hermes said—"Since the knowledge of our Stone is a gift of God, I hold this science only by divine inspiration." So then, my child, you, who are an investigator of wisdom and who seek truth in the true substance to arrive at the natural and universal philosophy, you ought to find this substance contained in a mineral which you will recognize easily by its weight, for it has the same volume as gold. The truth of nature is a truth which is hidden in the belly of this mineral.

Open the entrails of this mineral with a blade of steel, and make use of a gentle tongue, insinuating, flattering, caressing, moist, and ardent. By this artifice, you will render manifest what is hidden and occult. The father of all, the thelesme of all is here.

I advise you further, my child, in order that you may not wander in so beautiful a path, do not go beyond the limits of the class of metallic things—for nothing improves itself otherwise than in its own nature. But so wishing to avoid a false step, you can still err by seeking a substance too ripe and too advanced, which you will not be able to disengage without a confusion which will alter it and render it unfit for use.

The Sacred Scripture says of Saul that he was a child a year old when he commenced to reign. This was taking the scepter at an early hour and ruling his people at a very tender age. But it is at this age also that the soul accustoms itself readily to the habit of all the virtues. One cannot commence doing well too early. There is an age, which is that of youth, where one is susceptible to all the good impressions that are given him. It is at that time that the spirit is docile and conforms readily to the most beautiful actions which are proposed to it and which serve it for a model.

But when these young and tender years are past, this

docile spirit becomes turbulent and agitated by the various passions which wish to dominate it. It was this which impelled the Prophet-King to make this prayer—"Lord, do not recall me into the midst of the course of my days." And does not the sage teach us this truth? when he says—"I had claim to a good soul from my infancy, and I have since encountered a body blemished and badly tempered." The virtues and forces of a reasonable spirit find their perfections even if the body is infirm and debilitated. These words of Saint Paul can also be applied to tender youth. Jesus Christ has said well to his Disciples—"If you do not become as children, you will not enter into the Kingdom of Heaven." In these passages, which are all spiritual, a sense can be found which has a bearing upon our substance, and the reader can find in them a double usefulness.

If you know this deserving and noble substance, you will have only to seek it to find it, and you will find it without fail in the earth and on the earth—but the freshest and newest is always the best. The earth has taken it to nurse. You ought to snatch the child away from the breast of its mother. It is necessary to deprive it of its natural nourishment to give it an artificial one; and, as it is impossible that this child will not have sucked with the milk some of the impurities of temperament of its nurse, you must have care to wash it, clean it, and purge it before accustoming it to a food other than that with which it was nourished formerly—and, although the change of diet ought to purge it, it will be necessary still for you to facilitate the effect of this purgation by additional preparations.

If this child does not suit you, and if you find it of an age already too advanced for it to be made to take another diet than that with which it has been accustomed to be nourished, open the breast of its mother with the blade of

steel, probe about in her entrails, and penetrate even into her womb. You will find our substance there, pure, not yet having taken any color from the evil temperament of its nurse. He who has undertaken our divine work (says Haly) without knowing the hour of its birth will reap only pain and affliction from it. Do not take this seed in its first origin. Remember that Saul was a year old when he commenced to reign. The instrument of art adds nothing new to nature in its origin.

Nature takes care of her works herself to form them, and, when they are so formed, then the air can blow and can work in harmony with this splendid worker, together to bring to perfection the work that she has commenced all alone. So, the philosopher, who shall find our deserving substance in its source and its first origin, will not be able to undertake to use it without corrupting the work of nature instead of giving it the perfection that he desires. But it is not so with the true philosophers who may wish to undertake our work.

It is necessary, then, to take the child which is going to be formed of our substance while it is still at the tender age which will give it the docility necessary to receive the first tincture of a very perfect metal. You will be able to bring it up easily by nourishing it with foods which are of the same nature as those with which it has always been nourished. If these foods are more indigestible than those which nature furnished it, it will be necessary to aid it to digest these foods by augmenting its natural heat with a foreign heat. So it will flourish in such wise that you will know that you have taken a good path and that whatever may arise will not be able to turn you aside from it. I assure you that this child will commence to reign sooner than did Saul; for the more adroitly the artifice is conducted the more nature works for herself—and she finds a greater facility in achieving what she has commenced

because art has flattened the road and has razed all the obstacles that can slow her progress.

It is for this reason that nature, not being able alone to accomplish the great work, does not fail to work at it conjointly with art and to pass the limits which are prescribed for her—because she finds no difficulty which forces her to stop at her ordinary boundary, the limits of which have now been extended.

Let us give thanks to God the All-powerful without the help of whom it is impossible to bring about these marvels.

End of the Second Part.

THIRD PART.

That the Substance declared in my second Part is the only one needed for the great work.

My child, I am not the only one who has declared the true substance to you. All the philosophers have written of it as well as I have, but in obscure and more shadowy terms. The reason you do not understand their writing is that they have not wished to observe in their books an order which would serve as a means of making them understood: certain ones have begun their treatises with the end of the subject, others with the middle, others with the projection, others with the multiplication, and one other has treated of the middle and of the end of the work and has expressly omitted its beginning. They have all affected a confusion—from which, however, it is not impossible to extract the whole truth; but before developing this chaos it behooves you to read only a few books (provided they are good ones). It is necessary to read them and re-read them without being disheartened, for if you do not understand them the first time you will understand them the tenth.

I swear to you on the faith of a philosopher that you will find by this means what you desire. Although this

way may appear tiresome to you, it is by so much the shorter, the surer, and the more comfortable—for all the experiments and all the practice, without a true knowledge and without a perfect theory, will not make you wise in our art. All possible sophistications will not instruct you in the least. Work according to the intentions of nature, follow the road that she has traced for you, and imitate her in all things. Nature makes clever.

Go, lazy man (says the Sage), take a lesson from the ant; look at his work and become wise at his example. Without having been taught or informed by any master, see how, during the summer, he lays aside his provision for the winter.

Go, likewise, examine in the mine and make the anatomy of the metal. Consider from what substance it is produced and of what it is formed. There is no seed more suitable to hasten the growth of the tree of wisdom and to sprout the fruit of the philosophers. The artist who intends to cultivate this plant ought then to be a good gardener. For this substance ought properly not to be called seed, but rather, root, a root which ought to be cultivated and much worked over to make it bear fruit. Do not therefore go in search of any other substance but this mineral root which is the true form of the metals.

In the vegetable kingdom, each herb, each plant, and each fruit produces its seed, which, being placed in the earth which is suited to it as its proper matrix, alters, ferments, and opens by a very gentle digestion produced by the external heat which, by the movement and influence of the celestial bodies, warming all bodies and causing in them an internal movement, excites in them this natural heat which consumes the food which is introduced by this exterior movement and makes them produce a germ which has the virtue of sprouting, growing, and multiplying.

Here is the true cause of the growth, maturity, and

advancement of plants; here is that which is the vegetable soul, that substance of which nature makes use in her ordinary productions. By this means you will be able to understand the sperms, the seeds, the roots, and the substances of all things, which sperms and seeds are produced each according to its kind, and each in its turn, being contained in a fecund womb which is suited to it, reproduces its kind—a thing which comes about as a perpetual revolution and reproduction.

It is so that the masculine sperm, encountering in the female a sperm of its nature, joins with it: they become incorporated and unite themselves inseparably, although they have different qualities, the one being warm and wet and the other cold and dry, the one being the agent and the other the patient, the womb which contains them being an earth of their nature. But who does not know that nature fertilizes nature, and that this seed, being retained in a place which pleases it, is augmented by a sanguine humor which is borne to it, to maintain it, by a gentle and penetrating heat, and which, serving it for a food, makes it enlarge and flourish.

For this humor, being digested by the internal heat of the womb and by that which it contains in itself, is changed to an intermediary substance which joins to the seed all the other sanguine humors that it gains and of which it makes use to enlarge and to augment an embryo which comes entirely from the substance of the mother—the masculine sperm serving only to maintain internally the heat which by a coction makes this humor of its own nature, separating and rejecting the heterogeneous humors which remain longer to serve as a warm bath in which the womb keeps and finds the heat that it needs for the formation of the animal that it contains. It is so that all animals are formed, each having in itself a seed which it produces of itself. Instinct and reason give it the means of placing it in a

suitable place where it can germinate for the conservation of the kind from which it is produced.

You see, then, by this reasoning that it would be in vain for an artist to undertake to work on the seed of a vegetable to make an animal, and that he would succeed still less who would use the seed of an animal to form a metal out of it. Each class has its common substance which is proper to it, and which cannot serve the purposes of any other class. Each species has its particular substance which gives it a different form. It is impossible then to change from one class to another—and from an animal a metal cannot be made.

But I do not believe that it is absolutely impossible to convert one species into another; because a seed, being altered by certain accidents, as by some impurity contracted in the womb, can very well degenerate from the species from which it was produced and can become changed into another less perfect, and in the same way, from the less to the greater, by some accident which might dignify the seed. If this has sometimes happened, as is very certain, then the thing is not impossible—but it is very extraordinary.

Windy persons please themselves by making alterations, compositions, and mixtures which they call transmutations. They congeal (they say) quicksilver either by amalgamating it with minerals or marcasites by coction, or with metals by fumigation, or by the juice of certain plants by digestion. But let them alone; they will not abuse those who have read our books. It is not from common quicksilver that they have struck this substance which can become only as quick and as slippery as it was before they worked on it. This is not a true congelation. These are all sophistications which are amusing to fools and ignoramuses.

The true children of science set themselves all only

toward the great work. Here is the end of their desires and the accomplishment of their hopes. Do not amuse yourself therefore with these bagatelles, my child: it is losing time to extract the Mercury of the metals, such as that of lead, of tin, etc. That of antimony by which I set great value will be of no service to you. I tell you this in good faith, for, before having acquired a perfect knowledge of the mineral substance, I worked like the others on all of the substances, although always contrary to my wishes, for I was associated with people who wished to follow only their own sentiment and who listened merely to mine—for which, evil has overtaken them. I saw clearly that they were in error and that they did not work on the true substance—for it is not enough to take care not to work on an altogether foreign substance, it is necessary to think of finding the nearest one.

A gardener for example can very well make a pear-tree produce apples and plums, but he will never be able with all his industry to bring about that a walnut-tree should produce pumpkins, that a vine should bear cherries, and that a fig-tree should produce mulberries. Aristotle assures us that the substance of the metals is quicksilver congealed and cooked up by a manner of coction. Still it is not saying anything to say so—for this quicksilver is not that which is sold in the shops, although, for wise men, it is as common as water.

It is this which has caused a great man to say that the philosopher recognizes our Stone even in a dung-heap, and that the ignorant person is not able either to believe or to understand that it is present in gold. The Stone perfects itself of itself, and it achieves itself in the only metallic substance. These words are very true; moreover they are taken from the *Code of Truth*. Other philosophers assure us that, in all the work, there is need only of Mercury and of fire, for the beginning, for the middle,

and for the end. All these passages appear very clear. However, I, who understand them as he does who wrote them—since I have held in my hands three times this substance so rare and yet so common, and since I have achieved this blessed Stone three times—I warn you not to let yourself be seduced by the apparent sense of these beautiful words. The truth is contained in them, but not in a manner to be found by following these words to the letter.

I find that Avicenna wrote more clearly of it when he said that our substance involves the gall, the excrement, and the putridity of the sun and the moon. Weigh these words well, for in them is contained not only the true substance but even the entire rule for the work. Solomon says that he who parades the treasures of wisdom before the eyes of a fool is speaking to a man stupefied by a profound sleep. By this token then, that man, who shall not understand either my words, which are very easy to understand and very true, or those of all the philosophers which I have mentioned in this work of mine, by this token I say, that man does not despair—for a time will come when the shadows which envelop his understanding will be dissipated by the continual and assiduous reading of the true philosophers.

It is true, then, without any lie, very certain, and very veritable, that the substance with which one ought to undertake to bring about the transmutation of the metals is a substance of pure metallic essence, and that it will be impossible to succeed in perfecting the great work by means of any other substance but this. By so much you ought to be persuaded that this quintessence of the metals can be found only at the source of the metals, where the mineral spirit is—pure, acting on the wet and the dry by a heat which actuates it without cessation and maintains in it a circular movement in all the parts of the dry and the wet. And it is this heat which makes the water dry up, com-

municating a part of its humidity to an arid and altered earth. It is also by means of this heat that this earth is dampened, not merely on the outside, but is even penetrated and aroused inwardly by a nourishing moisture which manures it, makes it fertile, and gives it the virtue of producing, germinating, and multiplying.

It is so that the vegetable spirit is formed. It is by this substance that it is maintained and lives; it is this that gives it the soul. But this effective spirit, subtle and rare, cannot be extracted in its purity nor in its simplicity; we cannot see it or handle it; it is not invested with bodily form. But it is of those forms so little material, that, far from resisting the activity of this spirit, it rather excites its movement and its action in serving it for a subject to be reduced to the species from which they have been produced. So this spirit, finding itself in the bowels of the earth, surrounded by confused qualities of moisture and dryness, and being retained in a space from which it cannot escape because metallic bodies which are heavy, hard, and opaque surround it on all sides, it is constrained to reflect upon itself, and, in its revolutions and circular reflections, it detaches and carries with it certain parts of a subtle earth to which it communicates its movement by penetrating it with its heat.

It is this earth to which the philosophers have given the name of incombustible Sulphur, and if you examine its nature well you will find that it cannot by any means be submitted to the action of fire—for it is itself only dryness and warmth which are the proper qualities of that element. But as this Sulphur, containing the spirit which has given it its quality, augments its movement, it makes it violent and rapid, and carries along with itself a cruder substance which was that with which it became charged when it had not yet acquired so much force. This substance is a moisture which is transparent and subtle at first, and then

later, in passing through the veins of metallic earth, becomes contaminated with certain excrements which make it thick and viscous. But this latter water, or rather, oil which, being composed of an earth and of a water less pure than the first, joining with them and retarding the movement of the spirit which penetrates them forms a thick, slow, and heavy substance which contains in itself all the properties necessary to receive a metallic form and which can be pushed and exalted to a supreme degree.

This is the Mercury of the philosophers that none of them have ever wished to declare openly. This is the substance that nature has given us all ready to cook and digest, to putrify, and to ferment, to get it into a condition to germinate, to thrive, to grow, and to multiply. It is nothing in the world but this substance. By this token, my child, you ought not to seek anything else but it.

This is our double Mercury, this substance white on the outside and red on the inside. It is of this that the philosophers have intended to speak when they have said that it is necessary to whiten the red and to redden the white, for the beginning and end of the work consists only in that. It is in this Mercury that the true Sulphur of the philosophers is contained, which aids the artist to perfection it and without which a man would lose his time, his pains, and his work. Our Sulphur is not vulgar (say the philosophers), but it is fixed and does not volatilize. It is of a mercurial nature and of no other.

Therefore, my child, you see very well that I have declared all to you when I have made you understand in what manner our Sulphur is contained in the belly of the Mercury, and that it is correct to call it internal Sulphur or hidden Spirit, which is no other thing than heat and dryness acting on the cold and the moisture, acting on the patient, the pure mercurial substance of which the Sulphur is the soul, since it is it which vivifies and sustains the

Mercury which would be, without our Sulphur, only a dead, unfruitful, and sterile earth. There is, then, good reason to say that Sulphur and Mercury are the proper and true substances of the metals. But we do not say that the Sulphur and the Mercury are the true substances of the metals, because it is very certain that this Sulphur cannot be without Mercury and that our Mercury cannot be without this Sulphur which is intimately united and incorporated with it, as the soul is with the body.

These two names of Mercury and of Sulphur are only names for one single substance which we know under the name of Quicksilver, or Mercury. This is the only name which can suit it perfectly since all of the philosophers are in agreement about it. It is fitting that the sages should impose names upon things since they know the qualities, the virtues, and the properties of them, the name being (as Plato says) the instrument with which the substances of things are designated and discerned. Then, to give convenient names to things, it is necessary to know them perfectly; and no one has this perfect knowledge if the true philosopher doesn't.

Conceive, then, at present that our true substance is not only of the essence of Mercury but that it is also strictly mercurial matter, and that there can be no other name which fits it but the name of Mercury. And by that, you see that the philosophers were right in saying that their Mercury is not the common mercury, that it cannot be found upon the earth, that it is everywhere and in all things, that, however, it does not manifest itself. All the different expressions have now no further need of explanation; they are not contradictory in any respect to all that you have just learned. Therefore make manifest what is hidden and make occult that which is manifest. I tell you, in that alone consists the work of the sages. Our gum curdles our milk, and our milk dissolves our gum, and they grow

in the Stone of Paradise, which Stone is of two contrary natures, that is to say, of the natures of Fire and of Water.

All that I have written above ought to have opened your understanding for the intelligence of the philosophers —for I have explained to you altogether well and have given you to understand what our Sulphur is, that the philosophers have also called Gum, Oil, Sun, Fixity, Red-Stone, Curd, Safran, Poppy, Red-Brass, Tincture, Dry, Fire, Spirit, Agent, Soul, Blood, Burned-Brass, Red-Man, and Quick-Earth. I have also given you a clear and concise explanation of that which the philosophers name Water, Milk, White-Wrapper, White-Manna, White-Urine, Cold, Moisture which does not dampen, Body, Womb, Moon, White-Woman, Changing-Habit, volatile, patient, Virginal-Milk, Lead, Glass, White-Flower, Flower of salt, Fleece, Veil, Venom, Alum, Vitriol, Air, Wind, Rainbow, Naked Woman, and so many other names, which are only for the purpose of making us conceive the qualities, properties, and the two natures of male and of female contained in our substance, which is nothing else but animated Quicksilver. It is this viscous moisture mixed with its earthy part, our Mercury, and the true foundation of all our science.

It is in this great number of terms that the wise men have taken pleasure in writing their sentiment relative to our science. All these names ought to convince you of the truth of our science for all of them have only one meaning and all of them have for their purpose only to expose the hermaphroditic Mercury to us. It is feminine if it is considered as separated from the Sulphur which it contains within it and of which it is the substance; but it is masculine if it is considered according to its Sulphur with which it is united so intimately that it cannot be separated from it; and it can be said of their marriage that they are both of them in the same skin.

sight by forcing it to see things to which it cannot pay adequate attention. Continue always to advance along your road, and in due time your curiosity will be satisfied.

But, if you take some other route, thinking by its means to arrive at the place where you propose to go, I assure you that you will be misled, and that, the farther you advance in these by-ways, the farther you will be from the great and veritable road, in such sort that you will find yourself altogether bewildered and will not be able to find any more the true road that you had taken at first.

I believe that I have explained myself amply enough with reference to our substance. I have fortified my reasoning with the authority of the best philosophers to make it understood that the substance on which one ought to work to accomplish the great work is nothing other than animated Mercury: That nothing else in the world but this single and unique substance can serve as medicine for the metals when it is set in operation by a wise artist who, following the intention of nature in the regulation of this substance, shall lead it without any difficulty to the requisite perfection. It is that (my dear child) that I desire with all my heart that you shall be able to accomplish. You will have in this world a foretaste of the felicity with which God will recompense, after this life, those who shall have accomplished suitably his divine Law by adoring him in spirit and in truth, and by loving their neighbor as themselves —all of the Christian and moral virtues being contained in these two articles.

End of the Third Part.

FOURTH PART OR THE SONGE-VERD.

Credible and true, because it contains truth.

In this dream all appears sublime. The apparent sense is not unsuited to that which it hides from us. The truth

shines there with such brilliancy that there is no trouble in discovering it behind the veil which, it is claimed, serves to disguise it from us.

I was buried in a very profound sleep when it seemed to me that I saw a statue, about fifteen feet high or thereabouts, representing a venerable old man, beautiful, and perfectly well proportioned in all parts of his body. He had abundant wavy hair of silver; his eyes were of fine turquoises in the center of which carbuncles were inlaid whose radiance was so brilliant that I was not able to sustain the light of them. His lips were of gold, his teeth of Oriental pearls, and all the rest of his body was made up of a very brilliant ruby. With his left foot he touched a terrestrial globe which seemed to sustain him. Having his right arm raised and extended, he seemed to support, with the end of his finger, a celestial globe above his head. And in his left hand he held a key made of a large, rough diamond.

This man approached me and said—"I am the Genius of the Sages; do not be afraid to follow me." Then, seizing my hair with the hand in which he held the key, he lifted me up and carried me through the three regions of the Air, of the Fire, and of the Planetary Heavens. He carried me still farther, well beyond that place, and then, after I had been enveloped in a whirlwind, he disappeared—and I found myself on an isle floating on a sea of blood. Surprised at being in so remote a country, I went for a walk on the beach; and, considering this sea with great attention, I perceived that the blood of which it was composed was quick and warm. I remarked even that a very gentle wind which agitated it without cessation maintained its warmth and excited in this sea a bubbling which caused throughout the isle an almost imperceptible movement.

Charmed with admiration at the sight of such extra-

paces. I had no sooner raised my eyes to look at it than I saw nothing whatever, and I became blind—at which my conductor began to laugh and his companions likewise.

The vexation of seeing that these gentlemen were amused at my accident caused me more pain than my misfortune itself. Seeing then plainly that their manners did not please me, that one who had always taken care to entertain me consoled me, telling me to have a little patience and I would see clearly in a moment. Then he went and sought an herb with which he rubbed my eyes, and forthwith I saw the light and the radiance of the superb City all of whose houses were made of very pure crystal—that the sun shone continually, for in this isle there was never night. They did not wish to allow me to enter any of these houses, but they were willing enough that I should see what was going on on the other side of the walls, which were transparent. I examined the first house. They were all built according to the same model. I remarked that their accommodations consisted only of a single story, made up of three apartments, each apartment having many chambers and spacious closets.

In the first apartment there was seen a hall ornamented with a damask tapestry decorated with gold lace and bordered with a crape of the same material. The color of the base of this fabric was changing red and green, enhanced with fine silver, and the whole was covered with a white gloss. Further along there were several closets containing jewels of different colors; and further there was discovered a chamber fitted out entirely in a beautiful black velvet which was decorated with many bands of very black and very lustrous satin, the whole being raised upon a jet structure whose blackness was brilliant and very radiant.

In the second apartment there was seen a chamber draped with white, wavy watered-silk enriched and relieved with very fine Oriental mother-of-pearl. There were

also many closets embellished with furniture of many colors, as blue satin, violet damask, citron-colored watered-silk, and flesh-colored taffetas.

In the third apartment there was a room adorned with very brilliant upholstery, of purple on a background of gold, more beautiful and richer without comparison than all the other fabrics I had just seen.

I asked where the master and mistress of the lodging were, and I was told that they were hidden in the back of this room, and that they would pass, in due time, into another which was separated from this one only by certain communicating closets, and that the furnishings of these closets were of all the different colors, some being of a cloth of the color of isabelle, others of a lemon-colored watered-silk, and others of a brocade of very pure and very fine gold.

I could not see the fourth apartment because it was necessarily out of the way; but I was told that it consisted only of a single room the furnishings of which were only a tissue of the purest sunbeams concentrated in this purple fabric at which I had just been looking.

After I had seen all these curiosities, I was informed how marriages were made among the inhabitants of the isle. The Hagacestaur, having a very perfect knowledge of the humors and of the temperament of all his subjects from the greatest to the least, assembled the nearest relatives, and put a pure and neat young girl with a good, healthy, and vigorous old man. Then he purged and purified the girl, he washed and cleaned the old man, who offered his hand to the girl, and the girl took the hand of the old man. Then they were led into one of these lodgings and the door was sealed with the same materials as those of which the lodging was built. And they were obliged to remain so locked up together for nine months entire, during which time they made the beautiful furnishings that had been shown to

mystical and flabby. It will be well, therefore, to emphasize his curative methods and thus isolate his psychic principles from the philosophy in which he delights.

My reason for making this contrast is that I have been presenting to the readers of *The Monist* an evolutionary theory which seems to me more satisfactory than the reasoning in vogue. If I stop here I may win out in a million years and then have a monument erected over my remains if they can be found, but on the present I would not have had the slightest influence. I want therefore in this article to show the value of the theory presented by its application to psychic defects. I shall leave out of this presentation all parts of the theory except those which bear on curative processes, but to do this I shall be compelled also to isolate the psychic principles of the Freudian school from their fondly cherished evolutionary theories. No one can sanely start a curative process without acknowledging his indebtedness to Dr. Freud, nor can he go far without throwing overboard the load of philosophy by which his cures are obscured.

Let me state a maxim which seems to isolate me from him but which after all brings us more closely together. Psychology isolates false remedies from the true, but as soon as the evil is located the cure depends on some objective change. The origin of fevers was as mystical as any problem Dr. Freud handles until the relation of mosquitoes to fever was discovered. Cutting out a thousand supposed causes of fever, the psychic effects showed themselves in an altered attitude of hygienists but the cure came from altering certain objective conditions. Such, it seems to me, is the test of every psychic theory. It does change attitudes but it must also point out the specific changes needed to make it effective. This means that cures are effected only as psychic disturbances are traced to their physical antecedents.

For this reason I deem the Freudian analysis of the subconscious defective. The classes formed depend on types of behavior when they should be made to correspond to the forces active in the physical background. Similarity of behavior may arise from radically different causes. The psychologist is thus apt to consider as ultimate what is in reality complex. He may talk in terms of instincts, or, if he be a Freudian, he substitutes wishes for them. I have no desire to combat the wish hypothesis, but when stated in terms of physical antecedents wishes separate themselves into two classes one of which is not a wish if the term is to be used in any definite way. A true wish is an incentive to action. An avertive wish is a restraint on action. I wish to do and I wish to restrain myself from doing. Both motives are real but the mechanism through which they act is radically different.

I shall explain this by a criticism of a familiar Freudian concept. A boy loves his mother and hates his father while a girl loves the father and dislikes her mother. Is this opposition to the parent of the same sex something that bubbles up from the subconscious world or are the causes physical and objective? My reply is that all hates have definite physical antecedents and are formed by a conscious process. Back of every hate are two things, a shock and a fear. The shock is some happening of the objective world, the fear is the reaction of the nervous system to the shock. The effect of this on parents and children is that discipline is enforced by the parent of the same sex while there is a laxness of discipline between parent and child of the opposite sex. Girls are disciplined by their mother, boys by their father. Mothers sympathize with boys when they are disciplined and fathers with their daughters. It seldom happens therefore that boys and girls grow up without thinking they have some grievance against the parent of their sex, and this grievance is augmented by the

feeling that the other parent encouraged this belief. But there is more than this; parents use their children of the opposite sex to arouse their own sex feelings. When a woman presses her boy to her bosom or a father handles his daughter's frame he or she may think that the resulting emotion is parental, but analysis shows that the emotion is sexual. Thus in innocence and also in ignorance a sex relation is established which, reacting on the child, excites a premature sexual development. The boy is thus sexually drawn to his mother while through coercive discipline he becomes antagonistic to his father. That elements of the father and mother complexes arise in this way can be explained without the use of subconscious philosophy. In the facts we agree but not in their antecedents. Wishes are compulsive and avertive, the compulsive are real wishes; the avertive are the result of shocks and fears. An objective impressment may create behavior similar to a subjective compulsion, but their differences become apparent as soon as a transfer is made to the objective background.

A wish is a subconscious urge. An instinct is a nervous mechanism. A shock is a sudden impressment injurious to the nervous system. How do three things so distinct get confused with each other? The cause, as I see it, is the tendency of an organism to convert what is injurious into something beneficial. It tries therefore to cover up the shock or to convert it into something not injurious. If either of these processes could work with complete success shocks would be of slight importance. But if covered up they are still there, and if transformed they may in the end become more injurious than in their original form. This is why if stripped of their disguises they become harmless. The new conditions are usually such that the original shock is not likely to be repeated while the disguised shock is of frequent occurrence.

The rise of hatred against Germany during the late war illustrates how shocks and fears are a conscious process. Americans were shocked by the way in which the Germans carried on the war. The sinking of ships, the killing of innocent women, the brutal invasion of Belgium pained all who heard of them. But this alone did not cause an entrance into the war. To it was added a fear of Germans evoked by vivid descriptions of the invasion of America by German armies. Now fear is added to shock, then comes hate and a wish to destroy. What was once shock and fear thus becomes patriotism by which the source of these new feelings is concealed. The soldier thought not in terms of shock and fear but in those of a lofty idealism, and yet the latter is merely the former disguised by the processes of his conscious thought. Jew-baiting affords another example of this thought-transformation. The anti-Semite starts his argument by a description of the vile character of the Jews. This is the shock element. Then he asserts that the Jews are driving everybody to the wall. This is the fear element. Race hatreds arise in this way and are as intense as the two elements are pronounced. But the process is logical even if the logic is bad. There is no instinctive subconscious race hatred. All its elements are in the foreconsciousness and the processes by which it grows are those familiar to every thinker. We shall get rid of race hatred by removing the shocks and fears which arise from race contacts, and not by altering human nature. Heredity has faults enough without being made the goat in this respect.

The facts needing explanation relate the method by which shocks are submerged. Odd as the process seems, its origin is not in the subconscious field but in the working of a principle which lies at the basis of all logic. Every logical process proceeds by the substitution of one term for another; if deductive, the substitution is that of a class

put in the place of a specific antecedent. We thus rise from individual perceptions to that of classes. Shocks differ from ordinary sensations in their vividness, much of which is lost if we think not of a particular shock but of the class to which it belongs. If a man does another an injury he either says all men are like this one and therefore bad, or this man is an exception and by this judgment softens the injury done. In either case we have transferred our thought from an individual to a class and judge accordingly.

In ordinary thought the particular is absorbed in the general, but if the shock is severe it does not lose its individuality but remains a submerged concept ready to disrupt the general concept if circumstances favor. When it reappears it has a new dress because it appears as a symbol and not in its original form. Anything in a class may become a symbol of any particular of the class. There is thus a transfer of identity. An injury done by a red-haired man may arouse an antagonism to all red-haired men or to any group of objects colored red. It may also be expressed in an opposition to some one element of the class, this element thus becoming the symbol of the original antipathy. When this happens the symbol chosen is some more familiar form of the original shock-producing object. The bark of a wolf might produce the original shock, but if not symbolized the shock would perhaps never recur. If we make a dog the symbol of the wolf the recurrence of the shock comes often since barking dogs are a frequent occurrence. The injury of a shock is thus increased when its cause reappears as a symbol.

The principle involved may be stated thus: A substitution is a shift from a particular to the class to which it belongs, after which there is a reversion to the familiar of the class. A shock thus shifts from its source to the more familiar of the class to which it belongs. The symbol of a shock is much more detrimental than the shock because it

presents itself more often. We can thus see how shocks become submerged and how in their symbolic form they are more injurious than in their original expression. A vast number of objects or single objects of more frequent occurrence may thus arouse the shock reaction and spread its injury.

It is this fact that renders the discovery of the original shock of so much importance in effecting a cure. The original may have passed from memory or be confused with other events in ways to make the isolation difficult, yet if the rediscovery can be made a new group of associations will soon obliterate it, but if not discovered it cannot be removed by any rational procedure. Yet in spite of impotence the process by which shocks are symbolized is typically logical because it is due to the conscious process of substitution. To confuse these happenings with what is really subconscious destroys all hope of clear analysis and blocks the way to fresh psychological discoveries. Shocks are not wishes even if a shock leads to a wish. The wish of this sort being avertive can only by courtesy be given the same name as compulsive acts which are truly subconscious. When the forces of these facts are recognized the many forms which shock disguises take become apparent. They may not affect health enough to create the need of a physician, but they are detrimental even in the case of normal people.

Of these, superstitions make a prominent class. They have concrete antecedents which, if they were not symbolized, would be legitimate restraints on action. But for the concrete injury is substituted a class which is made vivid by some apt saying arousing shock reactions and evoking fear. Familiar objects like a cat, colors like black or sounds like a croak, thus get a significance which thwarts rational explanation. Of these, death omens are the most frequent. Specific scenes are covered by the transforma-

tion and associated with the most innocent events. Three candles in a row or thirteen at a table would be meaningless to a person who never had had a death shock, but once death or misfortune has occurred and fear is aroused the particular source may be forgotten and yet reappear in a thousand disguised forms. It is interesting to find that a premise formed by a logical process never can be reversed by the use of logical argumentation. The symbol is always attributed to some other cause than the one to which it is due. Instead of analyzing this thought, the victim of a superstition creates still another superclass and from it argues backward to sustain his premise. He thus gets farther away from, instead of nearer to, the real origin and becomes more stubborn in his position. The only solution is to get him to revive his early experience and then his superstition decays.

Closely allied to superstitions are dogmatic opinions. They start from shocks just as do superstitions and have their origin covered in the same manner. The dogmatist charges against classes what individuals have done. He is never content to denounce John Jones whom he dislikes for reasons good or bad, but forms great classes of which Jones is assumed to be a member. One bad Russian thus turns all Russians into Bolshevists, and one cruel German transforms his whole nation into Huns. The bad deed may be forgotten but the class becomes enlarged every time it is recalled and thus transformed by some new symbolization.

This process should be distinguished from one that is closely associated with it in name but which, after all, has a different origin. The belief in luck and the fear of misfortune or death are not opposities. Misfortune is a shock due to some specific objective event. Luck is a state of elation due not to specific past happenings but to some expected event. Its origin is thus in a state of mind making it sub-

conscious in the sense that dreams and myths are. I have never had a severe shock and hence have no death or injury superstitions. Three candles in a row or thirteen at a table creates no reaction. But I never see the new moon over my shoulder without thinking of its import. From the way I take my evening walks I see the new moon over my left shoulder about four times as often as over the right, Yet it never depresses. But if I see the moon over my right shoulder I am distinctly elated and expect all the month some pleasing event to happen. I also watch continually for lucky numbers. I cannot keep my eyes off street and railroad cars, automobiles or any other number series. When not in the woods it is no exaggeration to say that I spend a half hour a day figuring out lucky numbers and am elated when I find one. I have, however, no unlucky numbers and am never depressed by any lack of luck.

My explanation the reader may accept or reject as he will, but it throws a fresh light on mental processes. Pleasure is primarily a physical discharge. Glands collect a surplus, and with the final discharge pleasure arises. This is why sex has so prominent an influence on thought. Its discharges excite pleasurable feeling, and whatever promotes discharge is therefore instinctively sought. Elation is one of these. The repressive restraints on organs and glands are thus relaxed as a result of which a discharge takes place. The feeling of luck elates, and the elation promotes discharge. We thus want luck and from it get a satisfaction in the discharge which follows. Every shock transforms itself into something to be feared while every discharge has antecedents by which it is promoted. Evoking a shock and evoking a discharge are thus quite different in their antecedents and consequences even if they are closely associated in the names we give them. The one is the consequent of an event which is forgotten; the other

by a defect in certain nerves. Be this physical analysis as it may, the mental results are obvious. Thought-processes are due to the association of ideas, many of which are ocular. The lack of recognition of sounds breaks the normal flow of association and thus results in ideas that hover about a given point because there is no open path along which they may move. Many of the worst complexes are created in this way, no cure of which is possible unless the defects of the ear are corrected. A writer on psychoanalysis recently gave this example of the working of the subconscious. A lady could not think of the name Milton. This he attributed to the fact that she formerly had a lover by that name which because of her new love she repressed. As a result she repressed not only the lover but also the word. I do not doubt but that the statement of the facts was correct, but it is the straining of a good theory to the point of absurdity to account for the facts as he did. Most persons as they grow old can remember faces much longer than they remember the descriptive word. This is due to the fact that sound-discrimination fades much earlier than color-associations. Hardly a person of sixty exists who is not troubled in this way and repeatedly says, "I can see the person clearly but I cannot think of his name." If this is a fact, and I think no one will doubt it, many of our mental complexes are due to defective hearing which checks the normal flow of mental association, thus narrowing the shifting of ideas on which accurate thinking depends.

It is but a step from these thought-processes to that of myth-making, back of which is a logic even if it be not that of the books. Scientific calculation is based on visual experience, and its order is that of external events. In contrast to this, natural logic is based on emotional experience, the flow of thought corresponding to the unconscious physical background out of which emotions arise. Each emotion excites its logical successor. Whether the person will

or not, his thought follows the series which the physical background imposes. The interpretation may vary with individual cases but the imposed order does not alter except when broken by some abnormality. Remove this defect and the normal flow returns. This is why the process of myth-making is so important in the interpretation of mental disorders. The physical series is a visual glow, a dark line or body and a rhythm. The glow becomes the sun, the dawn, the maiden, or another of the various symbols of a like import. The dark lines become a prison, a jailer, a dragon, a demon, or like restraints. The rhythm becomes a god, a hero, a savior, a horse, a train of cars, or other symbols of movement. Then comes sacrifice represented by winter, pale colors, death, discipline, and the like. And finally there arise the thoughts of rebirth, redemption, spring, growth, purity, immortality, perfection, and other goals which imply success. This last step comes as a miracle. Dawn is not a logical sequence of night but a freshly wrought miracle. Spring likewise is not a sequence but an ever-recurring break in the natural chain of events. "How can life come from death," the primitive thinker asks. When he sees the change he is freshly astonished each year. No number of recurrences convinces him that it is a normal sequence. It is the emotional order, not the visual which his thought follows. In tragedy and wish-fulfilment he gets more pleasure than in nature study, and thus the repression of emotion and its release fixes this thought-sequence no matter what visual experience demands. Along with a belief in miracles is a belief in luck. Both imply an escape from disaster, a thwarting of natural sequence by extraneous forces. Through one or the other an unexpected deliverance comes; it matters not which so long as the emotional flow completes itself with its accustomed climax.

This may not seem logic, but it is logic in the sense that

it is repeatedly verified by the order of emotional experience. These simple sequences, the maiden, the prison, the hero, the sacrifice, and rebirth, may be symbolized in a thousand ways, but they are always present if thought-processes are normal. The classes into which emotional thought divides itself are not those derived from a scientific nomenclature but from the elements of this series. The moon, a mother, and a death have nothing in common when ideas are based on scientific fact, but they are symbols of the same emotional flow and thus readily replace each other in typical myths. A jail, a bluebeard, and a serpent likewise get in one class because they are the representatives in consciousness of the same physical antecedent. So long as the physiological series works normally the thought-series is compelled to follow. It is a compulsion, not a choice. Deviations from this order imply not a change in experience but some abnormality in the underlying physical mechanisms. From these abnormalities science should be able to detect the physical source and thus effect a cure. The obvious thing in abnormal myth-making is that the miracle does not happen and hence rebirth does not take place. The pleasure of rebirth and its transformations are thus thwarted with the result that the person is thrown back on the first element—the maiden—for his pleasure. This makes him a sex pervert since his pleasure comes by exciting his bodily organs. More important than this is the tendency to turn the hero who normally saves into a destructive demon. The pervert hates those whom, if normal, he would love. His friends or the society of which he is a part becomes a foe he is anxious to destroy. Against them he charges the ills his shortcomings have wrought on himself. We see this in a mild form in the fierce denunciation of others common among those whose thought physical defect or social misfortune has prevented from moving in normal channels. In severe cases it is *dementia praecox*,

a condition which creates an involuntary antagonism to those who in normal states would be viewed as friends.

For this perverted myth-making there is a mental cure since the blocking comes as often from mental as from physical causes. The repression comes from the scientific opposition to the miracle which in myth-making is the antecedent of rebirth. The miracle in myth-making is not in opposition to nature but a belief in extraordinary events. The change from winter to spring is in the myth a miracle but it happens every year by a process capable of scientific explanation. Yet by scientific analysis men lose belief in miracles and the corresponding luck beliefs. A repression of normal processes brings results not unlike what happens when morality represses sex. Science tells us that acquired characters are not inherited, and yet the logic it upholds is acquired. If so, it cannot alter the emotional processes. Men must believe in miracles or become abnormal. Take it away and a distortion of mental processes results. It is this fact which makes religious movements, even when crude, so effective. Reviving the belief in the miraculous they restore confidence in personal achievement. Scientific calculation says, Never do if the expense exceeds the cost. The myth says, Rescue the maiden at any cost. This is the spirit which enables men to do great deeds. The miracle is sure to happen if the happening is worth while. Science must mend its ways if it would be an emotional helpmate.

Myths and superstitions as well as shocks and strains should be put among the conscious mental processes which when done enables the truly unconscious processes to be presented in a garb which permits their explanation. They all seem to be tropic in their origin and unmechanical in their execution. Acts are done because they must be done and not because there are mechanisms by which they are done. This is why they seem mysterious and lawless but

the mystery disappears as soon as the nature of tropic acts is recognized. Tropisms are compulsions due to the direct action of physical forces. They make up for the structural deficiencies of organisms and hold organisms to given behavior until structural deficiencies are removed by some evolutionary development. Then they appear elsewhere in some disguised form.

Tropisms are of three sorts: physical tropisms, blood tropisms, and visual tropisms. I state this series to make plain the difference between it and that in common use. The accustomed order is tropisms, instinct, conscious thought; the source of the latter two being sought in the nerves. Few fundamental laws have been expounded by the students of nerves because the different parts of this series do not have common antecedents. Avertive and compulsive acts are confused under the common title of behavior; nor are the non-mechanical elements in conduct isolated from the structural and mechanical.

In contrast to this the relation of physical tropisms to blood activity becomes apparent as soon as the action of the bodily glands which throw their content into the blood is studied. The blood charged with these products has all the physical elements in it which create physical tropisms and provoke the same responses. In physical terms these effects cannot be readily measured but disguised as emotion they play the same part in the conscious field that their physical counterparts do in bodily action. A man in love acts as a miller in the presence of light. He moves about a woman with the same spasmodic reluctance as does the miller, and the force is as tropic in one case as in the other. There is no nerve in the man which carries these impulses from the sex organs to the brain. The sex glands discharge into the blood and the blood excites the proper mental emotion. The resultant is a tropic compulsion, not an instinct or a nervous reaction. Every

gland produces compulsion of some sort the measurement of which can be made in the resulting emotion.

Visual compulsions are complicated resultants of the same forces. Consciousness is like a plane partly covered by shadows. Each combination of the dark or light thus becomes a form capable of interpretation. Some forms are in silhouette, being combinations of the dark surfaces, while others are the visualization of the light sections. The figures in silhouette become objects of fear while bright objects are regarded with affection. Each form or color becomes a compulsive force which attracts or repulses, as it augments or reduces the flow of the physical forces upon which vital processes depend. The flag, a picture, or a sunset does not act on us through some structure. They create compulsions apart from any mechanism. All art is thus tropic and so is every cosmic enthusiasm.

The opposite of these physical tropisms is a type of disorder scarcely recognized. The various organs of the autonomic system are not connected with each other by a physical mechanism but exert their influence on the other organs by the products they throw into the blood. When each organ of the autonomic system exerts this tropic power, the whole system performs its inherited functions, but any drain on the autonomic system not only reduces its surplus energy but also takes from individual organs this tropic power. The key to a restoration lies in the ancestral stimuli to which the autonomic system readily responds. It is said that the late war relieved the hospitals of their neurasthenic patients and that its close brought them back. It would be fitting to call this disorder auto-asthenia—self-weakness—since the trouble is due to a disease of personality. Personality is acquired through the unified action of the autonomic system without which the central nerves cannot repress abnormal behavior.

A knowledge of these facts is of importance not only

to the helplessly abnormal but to every one who would improve his conduct. This cannot be done without a clear consciousness of the difference between shocks, strains, and tropisms. Each of these antecedents has its indices in consciousness through which they may be studied and detected. Psycho-analysis is thus the true starting-point for the study of mental disorders, but the progress will be slight until mental phenomena are classified not according to their visible similarities but according to the underlying forces whose resultants they are. Cures come not by mental analysis but by the transference of the investigation to physical causes. No thought without a physical antecedent and no antecedent without a mental consequent, is a good axiom for all investigators to adopt. The categories of thought and of its physical background must be brought into harmony, and this can be done only by keeping discussion carefully within physical terms. Only those who are free from physical defect can afford to be blind to its sources and consequents.

There is one more contrast needed to finish this discussion, and that relates to the difference between dreams and myths. Both are tropic in origin, but their mechanism is not the same. Tropic compulsion is accompanied by gland discharges. Dreams in their simpler forms are the mental antecedents of these discharges. When the discharge takes place the person awakes. Dreams both day and night are thus striving for pleasure which leads to a waste of energy. When we follow the lead of pleasure we are sure to incur some physical waste and thus to reduce the effectiveness of adjustive action. Myths are more than a dream because in a dream the person is the center of action. The self remains constant while the viron is always altering through the frequency of substitution. In a myth a hero or god is substituted for the person creating it. The myth-maker sees himself in terms of the

class to which he belongs and thus puts class ends and race enthusiasms in the place of his personal inclination. He thus transforms himself from a mere enjoyer to a doer, and his energy goes out not as mere discharges but as muscular activity directed toward cosmic ends. He becomes will instead of wish and loses the burden of personal motives which conflict with race ends.

I say this to meet the objection raised against the emphasis of physical antecedents to thought. The charges are that such a procedure is material, mechanical, hedonic, and individualistic. All these charges can be readily met. Tropic action is neither material nor mechanical. It antedates the structure which makes action mechanical. It is hedonic and personal only in so far as the individual indulges in day or night dreaming. Art, drama, song, religion, and literature transform this yearning for personal enjoyment into a cosmic endeavor. Should a clear analysis of physical antecedents become the common property of the race it would show personal ends and pleasure-seeking to be a defect and thus lead to a restraint of the tendencies by which they are fostered. A correct analysis of thought-mechanisms does not lead to mechanical thinking and acting but to the highest form of idealism. It is the emotion back of myth-making that in the end dominates both personal and race activity.

S. N. PATTEN.

PHILADELPHIA.

CRITICISMS AND DISCUSSIONS.

WHAT IS A RELATION?

Professor Royce says, *Encyclopedia of the Philosophical Sciences,* Vol. I, p. 98, "In brief, a relation is a character that an object possesses as a member of a collection, and which would not belong to that object, were it not such a member." Again he says, "But in contrast with qualities, the relation in which any object stands are characters that are viewed as belonging to it when it is considered with explicit reference to, that is, as in ideal or real company with another object, or with several objects."

Here we have the effort to define relation in terms of the object. The relation is a character of the object. The effort to find the relation in the object will be vague and therefore not illuminating. The object qua object has no relation. This explains much of the controversy about relations. When the test comes, relation, say causation, is shown to be not there. Let us illustrate with a sense-relation. The horse is tied to the post. The halter is the relation. If the halter is absorbed by the horse or the post, it is impossible to tie the horse to the post. This is why the billy-goat could not be shipped. "Boss, he dun eat up whar he is agwine." The sense-world demands that the relation be as genuine as the objects. Can logic meet this demand? I think not so long as we define relation in terms of the object. To make the relation a phase of the object is confusing and loses the relation.

Louis Couturat in his chapter, "The Principles of Logic," *Encyclopedia of the Philosophical Sciences,* p. 170, seeks to define relations as belonging to propositions. The kinds of propositions will give the various kinds of relations. A relation, says Couturat, is a proposition having several terms; or more exactly, since we ought to consider these terms as variables (empty places), which are not part of the relation, it is "a propositional function having

several variables." That a proposition embodies a relation is clear. Were there no relations there would be no propositions. The proposition is a statement of the relation existing between the fact and its type. The relation precedes the proposition. It is not a quality or function of the proposition, but makes possible the proposition. It would be better to say that the proposition is a function of the relation. We can have a false proposition. That is, a proposition that attempts to state a relation, but fails. The proposition is stated; but the relation is not, and so the proposition fails. Propositions are the expression of relations in the mental sphere. Relations are objective as well as subjective. Objective relations, such as halters, affinities, laws, are not propositions. They are rather the content of many and varying propositions.

The mental process appears to exhibit itself in words, in type-words, then in propositions.

It would appear more exact to say that the proposition and the propositional function are illustrations of relations. They exhibit one kind of relation. They do not answer our question, What is a relation?

In the "Deduction of the Categories" Kant gives four classes. These four classes contain the elements of the knowing process. These elements are pure. That is, they belong wholly to the mind. The four are divided into two, the mathematical and the dynamical. First in the dynamical list comes Relation. And there are three relations: (1) *Der Inhärenz und Subsistenz;* (2) *Der Causalität und Dependenz*; (3) *Der Gemeinschaft.*

The third is, he says, the union of the first and second. According to this account, relation is a category and categories are pure. They are the conditions of experience, never the product of experience. They are the elements contributed by the mental sphere. And relation is a category. Kant would appear to support Couturat. I think it must be admitted that some relations are categories. Are there not others? Has Kant told the complete story? What shall we say to those good people who insist that the nature-process is not the thought-process? Kant himself says the process of the *Ding-an-sich* is not the thought-process. How to relate the thought-process, the nature-process, and the process of the *Ding-an-sich* remains a problem to the doughtiest Kantian.

Our question remains, What is a Relation?

While the "Deduction" may not answer our question fully, it

does clear the nature of the problem. *"Verbindung liegt aber nicht in dem Gegenstand."* Take the simple example of the multiplication table. It does not lie in the object. No possible manipulation of apples can produce four. Cider, apple sauce, pies may be had, but never a four. No amount of wheat, nor kind of wheat has in itself the measuring quality. To discover the number of bushels in a pile of wheat is no part of the process of wheat life. The number of bushels is not wheat, but knowledge. It is correct knowledge. And this knowledge is in terms of bushels, not in terms of wheat. In this sphere it will be admitted, *"Verbindung liegt nicht in dem Gegenstand."*

What is this relation? Kant terms it *Einheit der Apperzeption.* He says this *Einheit* is a *Grundsatz,* and this *Grundsatz* is *"Der oberste in der ganzen menschlichen Erkenntnis."*

Relation is an *Einheit,* that is, a state of unity. Relation is not a product, not an association, but a state of unity. This is substantial. Can we say anything more? Yes. This *Einheit* is transcendental. That is, not in any sense a product. It is original. And this according to Kant is as far as one can go.

Is it possible to take a step beyond Kant? To end our search with the elusive, transcendental *Einheit* is not illuminating nor satisfactory.

Let us consider.

We wish an insight into the relation in terms of itself. Relation is not the object. As object, the relation is denied. The mark of relation is expansiveness. Relation is not limits. This moment of negation is absorbed. The halter that holds the horse at the post is a sense-relation. It may be a foot in length or a mile. In each case it is a relation. The place of the horse is another relation. This place may be a pen, a farm, a county, a state, a world. In each case the horse is related as to place.

It is this mark of quantity maintaining its identity in difference that is relation. The square of two is four. And yet two square is not four. The identity in essence is relation. We may now define relation as the schema by which the substance maintains its identity in varying forms. The one-many relation is the classic illustration. The one, which is quantity, maintains itself in the forms which are many. The quantity, *one,* has the quality of being itself in its other.

And so we come to the second definition of relation. It is the identity of quantity and quality. The quality here being the varying forms of the one quantity.

Two things are important here. First, the relation is quantity. It is the one in the many. The quality here is a mark of the quantity. Secondly, the quality is because of its relation to the quantity. There is abundant illustration of this in theology, in morals, and social life. Forms come out of the one as source and must be imposed upon the many, if they are to have value.

Kant makes relation a dynamical category. This made it impossible to complete his research. In the end the category was for him a transcendental *Einheit* that escaped the utmost reach of knowledge. Had he seen that relation is quantity, he would have been more complete in his analysis.

Relation is quantity. This quantity has the quality of maintaining itself in variety of form. So far our path is simple and clear. Qualities find themselves as related.

Now comes the task. Qualities are not forms imposed upon the object by the one. They are in and of the object. They lie in the structure of the object, in its life. We now get a genuine difference. The world is split into two kinds all the way down. We seem to lose the relation.

This problem has tested the full might of the Western mind. The solution is modern civilization. The instrument is science. The list of schema created is impressive. Theory, law, cells, evolution, germs.

These schema have a common purpose. They will maintain the relation in the presence of qualities, let these qualities vary as they will.

At bottom this relation is quantity. This is the logical significance of the conscious effort of each science to state its findings in mathematical terms.

At another time I hope to exhibit this movement of the Western mind to seize the relations in the changing world of life. It is the Logic of Science.

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WISH AND WILL.

A REPLY TO MR. SALTER'S LETTER.

My pleasure in Mr. Salter's article in the October *Monist* is akin to his pleasure in mine. Both are trying to present new facts in old language and stumble in the attempt. The best that can be done is to avoid certain terms and to use other ones in a slightly different sense. When an expression is altered a singular often becomes a plural and what before was multiple gains a unified term. For this reason I avoid using such words as *ultimate, permanence, reality, original*, and *primary* which raise questions that have no point when restated in modern terms.

There was a time when everything was assumed to have a foundation and to be held up by some material support. Language developed in this period and has not been altered to meet new conditions. Now, we should not think of things being supported, caused, or as being ultimate but as parts of the series through which they manifest themselves. All change resolves itself into changes of form, never into change of substance. Any series can be traced in a fixed form for a given distance and then is lost. To go further means to hunt the consequent in the new form it assumes. We can therefore consistently ask what is the antecedent in a series and what the consequent, but it is a mere puzzle to ask what is the ultimate or which the reality. Each antecedent is in turn a consequent and each consequent an antecedent. Wherever a beginning is made there is a consequent; when we have traced it to some preceding form there we have an antecedent which in turn may be a consequent in another series.

It is only by making the ultimate something concrete which cannot be transformed without losing its essence that the opposition arises which older thinkers found between the material and spiritual. If spirit and matter are entities all hope of a consistent philosophy disappears. Instead of thinking of ups and downs which leads to irreconcilable ultimates we should use terms that imply a circuit, thus permitting objects to be both before and behind each other. A dog chasing his tail is both ahead and behind his tail. Perhaps my evolution in this regard will help others. I wanted an economic interpretation of history based on food production but found that it exhausts the soil and leads to diminishing returns.

I strove therefore to find ways in which a return flow is obtained giving back to the soil what is lost in production. Finding this impossible in terms of soil I sought a larger circuit. Food becomes what?—Bone, muscle, and blood. Here I struck a snag. More food should lead to better blood and muscle, but I found it said that uplifts came not through better food but through toil, hardship, and sacrifice. This doctrine can be refuted by showing that the measure of good diet is not its quantity but the amount transformed into pure blood. It is this surplus that counts and not the waste incurred.

No sooner did I get to blood than a new obstacle intruded. Thought, it is said, depends on the nerves with which blood-processes have little to do. If this is true the circuit fails as fully as it did at the other break. But if thought-processes are fundamentally blood-processes, not nerve stimulation, another step may be taken in the circuit. This is true if the antecedent to consciousness is a blood illumination, not a nervous shock. Shock is a form of illumination, not illumination a consequence of shock. The nervous circuit is a side circuit helping in adjustment, but not the source of conscious life.

At this point the series shifts from a physical to a psychic basis. Every illumination has a form and it is through the form that the interpretation takes place upon which thought-processes depend. Nerve action arouses thought only as it alters the form of the illumination we perceive. Form is the basis of thought; conscious processes are its interpretation.

If this is correct the rest of the circuit is easy traveling. The form becomes wish, the wish creates structure; with the aid of structure it becomes will, and will through muscle transforms the external world in the direction of wish-fulfilment. A better world results in which more food is produced. A new circuit then begins with a greater effectiveness because it has back of it at each step a greater surplus. Each circuit on its physical side produces more surplus and on its mental side better articulated forms. Surplus and form are thus the measure of progress, each in its own sphere.

I do not state this to show it to be logical but to show the nature of a circular process. In it, every element is both ahead and behind its neighbor. Each particular investigation can be carried on in its own terms for a while but soon a substitution must be made and a new series created that starts with itself and ends in something else. It is just as true but no truer to say the antecedent

mere trinkets in comparison with the Wish and the Will which makes the universe move onward and upward. The *Was* never equals the *To-Be*.

This view will be called anthropomorphic. So it is. I accept a term meant to deride as a mark of honor. We do create God in our image and give him attributes we cherish. But if our wishes are the outcome of an urge that all feel, pointing to ends which all structure strives to attain, then the true God can be no other than the wished God. We make him and he makes us. It is just as true to say that God is a manifestation of nature as to say nature is a manifestation of God. The wish makes structure and the structure aids in wish-fulfilment. This is the ultimate circuit after which all other circuits are modeled. The higher concept of God is not that he is perfect, absolute, independent, and underivable. He is due to a long series of circular processes just as our material world is. Neither were made in the sense that they had a beginning but both grew in the direction of wish-fulfilment. The Growing, the Becoming is the Ultimate. Philosophy cannot make concepts so perfect as those revealed in nature's processes.

The difference, if there be one, between Mr. Salter's position and mine is the relation of the foreground of thought to its background. He seems to imply that the foreground—that of which we are directly conscious—is less than the content of the background; the latter being permanence, reality, and cause. To me the foreground and the background are on an equality. The foreground in any case is the part of a whole which we see, the background is what we infer. In this sense it is possible to speak of the physical background of consciousness as its antecedent without giving this background any priority. Structure is not a group of lifeless molecules arranged by chance; its background is a wish and wish-fulfilment is its end. To it, the wish is the unseen just as the physical is unseen in consciousness.

If nature is made of absolute unchangeable units there is no evolution. We should be honest in our thinking and decide this fundamental problem apart from the conclusions which follow its acceptance. If evolutionary processes mean anything we start at each stage from objective chaos and subjective wish and end the epoch in objective cosmos and subjective will. Wish acting on chaos creates cosmos; then cosmos and wish become will. In other

words, cosmos is the structure through which wish is transformed into will.

Wishes are in their essence desires for permanence. We want to be immortal, we want reality, we want the absolute. All these are attained through structure and to the degree that they are attained we have the cosmos of the external world. Such are our crude wishes which become embedded in objective structure in the fulfilment of which our material satisfactions arise. But wish acting through this structure ceases to be wish and becomes will. It no longer wants permanence and reality, but yearns for self-expression. Thus wish and will get to be opposing forces. As wish I want permanence, as will I strive to become manifestation. I then place less value on self-preservation and more on self-expression. Will is thus a movement from reality to manifestation while wish moves in the opposite direction.

Wish is thus the antecedent of structure—will its consequent. We get the power to do what we wish and then strive to do something else. Hence the circuit—wish striving for reality while will turns reality back into manifestation. Every man has both these urges in him.

Shakespeare lives in two ways. The libraries contain certain texts which give a material embodiment to what he wrote. But the greater Shakespeare is the influence he exerts on subsequent thought. This Shakespeare has no permanent structure. It is now here now there but always present. If all the copies of his books were destroyed he would still live, ever shifting his embodiment to new subjects. This is Shakespeare as will, or as we say, the spirit of Shakespeare.

So, too, our nation and our culture lives in a material form in our laws, art, and other objective structures, but they also live in a supersensual form in the spirit they evoke. They move from age to age not by heredity nor by permanent structures but as a manifestation without an enduring substratum. There is always a clash between those who want permanence of government or art and those who are moved by the spirit our institutions and culture evoke. One element is wish urging continuance and the other is will striving for self-expression.

That sex is wish has been ably presented of late, but advocates of this err in assuming that because it is wish and therefore fundamental we should yield to it. We do wish for sex pleasure, we do

want race continuance, but the process which leads to the fulfilment of these wishes has resulted in the creation of will, and will wants not sex pleasure but some form of self-expression. Will, therefore, suppresses sex that it may gain an end attained not by its own permanence but by its becoming a supersensual urge which lacks a permanent background.

Christianity has always been at cross purpose with itself because it includes the wish to be immortal and the concept of losing life to live in others. The two views are patched together by theological interpretation but the opposition is not thereby dimmed. Christ doubtless expected death as did Socrates. Thought of without resurrection, he is will striving for self-expression; as resurrection he is wish for permanence. Religion is thus either a scheme of self-perpetuation or a manifestation of self through a changing background.

The success of this paper depends on whether I can make clear the difference between the supersensual urge to transform oneself into other more effective forms and the physical wish to continue in some one form. The wish always strives for something specific and permanent. Will seeks for a flow that lacks a permanent embodiment. What I am, wish seeks to continue; what I am not, will seeks to gain. The two are, however, mutually dependent; each is before and after the other. Between them a circuit is formed which results in a permanence of structure which is wish-fulfilment but also in a rapid transformation of structure which is a manifestation of will. Nothing is so temporary as the psychic if we think of it in terms of its physical background, nor so permanent if thought of as an enduring influence. This supersensual heredity is as real as its sensual counterpart. Each would fail but for the possibility of substitution at points where it loses its effectiveness.

I state these things that I may not be open to the charge which Mr. Salter's words imply of putting the physical before the supersensual. If I have done so the facts can just as well be put the other way. If life is a process it is both these in turn. In each the other may be found if we are not led astray by words. Language helps us when we talk of ultimates, permanence, and reality. We can readily tell what is above or below, what abides and what disappears. We have a great affection for the "Rock of Ages" and little respect for what flits from form to form. All our words imply that whatever changes loses and whatever endures is superior. Mr.

Salter seems to assume that what can be well expressed in words has a superiority to that for which the expression is vague. To test him I shall not ask him to prove he is permanent, absolute, immortal, but ask what is the value of these concepts as compared with self-expression? Would he rather be permanent than be influential? This I understand to be the difference between wish and will. To-morrow's sun must rise on another world. Each form must die to make way for a superior. This is will but it is not wish. Is a sensual immortality better than a transforming influence?

There is a possible confusion of thought it is well to avoid before closing. Can manifestation alter reality? This is a restatement in broader terms of the biologic problem: can personal activity influence the germ-cell? The believer in the absolute has always held what the biologist has now put in concrete terms. If activity can influence the germ-cell an orderly progress of organic beings results. In a deeper sense this is also true if manifestation can alter reality. But if both these questions are answered in the negative no orderly evolution can occur. Accidental changes would still be possible. We might wake up to-morrow and find that germ-cells, atoms, reality, and God are different from yesterday, but on them we could exert no influence. If, however, the difference is a relative one, they being subject to slow cosmic changes and we to the rapid flow of sentiment life, then the reality which is behind all slowly alters to meet first the wish and then the will of transient creatures. In an orderly evolution wish and will must in the end mould reality just as in the biologic evolution action must influence the germ-cell. Between these two views the thinker must choose. The problem is to make the choice a rational one.

What follows is not needed to answer Mr. Salter's questions but is a necessary preliminary to any discussion which may follow. The essential element of my position is the thought of circular processes—transformations which end not in a new creation but in the return of the original in some more complex form. Each circuit means therefore some advance the sum of which is evolution.

Processes are of three kinds, two of which are familiar while the third never has attained the place it deserves. In a mathematical process the terms of the series retain their identity, nothing is either added or taken from their content; in an analytical process elements are subtracted at each step with the result that some pure form is

in the end obtained. This process if judged by results is a devolution, not an evolution. Analytic processes are found only in artificially constructed laboratories while mathematical processes are thought-processes carried on in human minds. All natural processes are synthetic since nature tends toward more complex forms, except where its forces are artificially isolated. It is therefore these syntheses we should try to follow and find how this greater complexity sustains itself.

The difficulty in following such a series comes from the fact that at no one time are all the qualities of the complex unit manifest. Every change makes certain attributes of the antecedent recessive; the new elements may so dominate that the unit seems an independent creation. This is the case with probably all the reactions which we call chemical and certainly is true where the antecedent is physical while the consequent is psychic. In such cases we are likely to lose sight of the fact that we are dealing with a continuous process and think of each link as an independent unit. We thus give to each link a name which indicates its manifest attributes ignoring the recessive traits which are as much a part of the unit as those which at the moment make their presence felt. A synthetic series cannot therefore be traced with the ease which mathematical or analytical series present. The parts seem independent and the isolation is made emphatic by the words we use.

There can, for example, be little doubt but that tropic and instinctive action are closely related, instructive action being more a complex because of the introduction of some new element. Yet we think of them as distinct because their manifestations are so different. A tropic act is judged by its physical antecedents while an instinctive is judged by the behavior which follows its action. We see only the behavior and not the recessive elements which are repressed. Yet doubtless the tropic elements are there and as active as ever, only their consequences are not manifest in behavior. Normal behavior is thus not only certain manifest traits but certain suppressions which prevent the outing of other inherent tendencies.

The doctrine of the subconscious rests on this fact. All of the antecedent tendencies, the simpler grouping of earlier complexes are as active as ever in the mind, but they have no means of manifesting themselves so long as the normal dominance of certain elements is maintained. Break this dominance and the action of the simpler antecedent elements comes to the fore. We then act as if we

were subnormal, subhuman, or even as if tropic reactions due to purely physical events were our masters. We save ourselves this confusion if we recognize that we are dealing not with independent units such as our words indicate but with a synthetic series of growing complexity every element of which is active but only a few of which are manifest in a given conjunction.

I shall give a series of these synthetic changes to illustrate my point, but the reader, to follow the series, must guard himself against the pitfalls which language creates. With each term he will have associations which dim the relation between antecedent and consequent, if not completely destroy it. Each term in the synthetic group will seem independent because we name it and think of it in connection with its manifest traits and ignore those which are for the moment recessive. With this warning I shall state the series and give a subsequent explanation of the connection between them which exists when we think of them in terms of their recessive attributes.

Tropism becomes strain.
Strain becomes visual form.
Form becomes association.
Association becomes wish.
Wish becomes structure.
Structure becomes will.
Will becomes cosmos.

We have no good word to use as the connecting link in these cases. Perhaps "is the antecedent of" or "is transformed into" would be better in specific instances. What I have tried to do is to name each step in the series of the dominant manifestations made at this point. This creates a jolt unless the reader keeps in mind the complex unit which is being carried along and thus disregards the associations the words almost inevitably impose on thought.

I start with tropisms because they have in them no element of heredity, being determined solely by objective conditions. But if a tropism is judged as conduct it manifests itself as strain. The part is held in certain fixed relations and other acts than the one manifest are prevented. Strain, however, is manifest in consciousness not as strain but in some visual form. By it, the internal illumination is altered into some figure and through it we judge of what is happening externally. These forms become associations or complexes, and thus we get a series of mental substitutions which

become the basis of thought-processes. Out of these arise our wishes and aversions, the one being the index of external adjustment and the other of nonconformity with nature. Wishes then become structure which aid in their fulfilment, and structure manifests itself in will. Will in turn is plainly the result of the pressure for wish-fulfilment, but when once acquired moves not in this direction but toward the betterment of cosmic processes. The circuit thus starts with a given perfection of cosmic processes represented by tropic actions and ends in an improved cosmos.

Such I take it to be the essence of a synthetic process. It seems disjointed because in each stage so many of its attributes are recessive. It is the only true natural process in spite of the fact that thought and laboratory processes seem to be of a higher order. Their simplicity, however, is their fault for it leads to the neglect of factors which are active even if incapable of observation. Some day we may manufacture a language which will enable us to carry a synthetic series through its complexities as readily as we now think in terms of mathematics or of the laboratory, but in the meantime even the most alert will lose their way in the intricacies which synthetic processes present.

There is a further point to which I return not because its bearings are obscure to Mr. Salter but because others may not see them as clearly as he does. To me, it is fundamental that the wish to do precedes the structural power to do what is wished. This will by most readers be turned into the familiar problem of the inheritance of acquired characters, to which I am not adverse if I am permitted to show the present status of this problem. The question thus asked cannot be answered by a direct yes or no but must be met by some new statement of the problem involved. By its propounders the doctrine of acquired characters was upheld by the assumed inheritance of birthmarks and defective traits. Subsequent investigations proved the falsity of these assumptions and thus left the original position without a firm foundation. Admitting this, is it not likewise true that recent investigation has undermined the opposite doctrine? Its premises are: descendants vary, numbers increase, the less adjustive fail to survive and thus arises a steady tendency for a type to vary in the direction of better adjustment, a doctrine which falls as soon as the Mendelian law and that of unit characters are promulgated. Variation in descendants is due not to the modification of unit characters but to their dominance and

recession. A person who does not manifest a given unit character may have it in his heredity as fully as he who manifests it. His descendant may show again the trait which seems absent in the parent. The apparent new is not new but a new combination of the inherent unit characters. Variation is thus merely a variation in dominance, not a variation in heritable traits. Under these conditions elimination merely reduces the variety of combinations which may attain dominance. It tends to produce a pure stock, not a new stock. We see plenty of evidence of this in the various species of animals that have assumed a fixed form. Elimination thus tends to a fixity, not to an improvement. The premises of the argument depending on variation and elimination are thereby undermined and the position of the orthodox group becomes no sounder than that of the believer in the inheritance of birthmarks and physical defects.

The solution to the problem involved must come from some new approach. Questions must be asked to which an answer can be given, and these must be more specific than those involved in the old controversy.

In harmony with this program I would first ask: can wishes influence structure? The only possible answer to this question is that they can. The wish to be a blacksmith leads to development of arm muscles. Exercise which has a wish back of it invariably leads to an increase of the power to execute.

The next question is: can the action of parents accelerate and retard the development of offspring? Here again the reply seems plain. Our educational processes are processes of acceleration. In each generation we transfer our wishes to our offspring at an earlier date and also give to them a greater power of execution. Wishes are thus not only transferred to offspring but also modify structural development in the direction of wish-fulfilment.

I shall at this point be expected to jump to the conclusion that acquired traits are inherited. But this is going too fast. We have control of one element of the problem but have left a more important one in the background which likewise needs a solution. Heritable action is through structures, and structures are the visible manifestations of unit characters. Is activity of this sort the first kind of activity or has it a predecessor? This brings up the relation of structural to tropic activity. Are we forced to make a given movement and then acquire a structure with which to do it, or must we wait for the appearance of structure before a given movement

can be performed? The essential element in tropic movement is that it is caused not by inherited structure but by the direct action of external forces. The act is done by the aid of light, heat, gravitation, or other vironal pressures. Do forced movements of this sort precede or follow the development of a structure to do the act, or do they follow the appearance of the unit characters out of which voluntary movements arise? This is the real question, and not, Are acquired characters inherited? To it there can be but one reply; the forced movement antedates the voluntary movement depending on structure and unit characters.

The difference between the two views of heredity can be put in this way. If forced movements come first an organism is held to the doing of a particular act through objective forces until the hereditary mechanism is developed by which the movement is made. It does the act and then develops a mechanism by which the act is done in a better way. No use is made of the concept of infinite variability nor of the influence of elimination. Heredity follows along the line along which physical forces compel it to move.

The accepted biologic theory runs counter to this. First variability of offspring, then overpopulation, and then elimination. Progress comes through the competition of living organisms; while the rival theory assumes that it comes through the pressure of external forces on all individuals. The rate of increase of a species is of no consequence if the pressure which leads to progress acts on all members of the group. We thus build a theory of natural compulsion as contrasted with a theory of natural selection.

I use these facts to get an issue in modern terms which when once stated and its import clearly apprehended can have but one answer; yet if left in this form the victory is a barren one. The vital question is not whether there are physical forced movements, but whether these are also psychic tropisms. As the moth approaches the flame because it has no mechanism by which to turn away, do we also act because of unseen forces which we have no conscious mechanism to resist? This is the problem of the unconscious. What we have in consciousness is a group of structural mechanisms, the outcome of certain inherited unit characters. In our subconsciousness we have a group of tropic forces which control our activity until mechanisms are inherited by which they may be suppressed. We gain in freedom as we grow in heredity since the power of suppression depends on the growth of heritable traits. If

this is correct the wish to do precedes the structure by which the act is done. I do not say the wish causes the growth of mental structure but merely that it is the antecedent.

The whole case can be better put by thinking of the wish as the representative consciousness of subconscious forced movements. What we wish we must do even if we have no mechanism with which to do it. It represents therefore the force which is compelling structural growth, while acquired characters represent the distance heredity has gone in the fulfilment of wish, or, in other words, the movement of heredity to meet the demands of the tropic forces acting in our subconsciousness. Wishes and acquired characters are not causes. They are indexes of the pressure exerted by underlying, as yet non-structural forces.

While I have used the term "psychic tropisms" to contrast them with "physical tropisms" I would not be understood to imply that they are *purely* psychic. What seems psychic is mainly physical. We get a better contrast by putting the nerves in contrast to the blood. Most of our heritable mental mechanisms are nervous and from them our conscious acts arise. Most of our mental tropisms act through the blood which in turn has its vital content determined by certain glands. If in the place of heat, light, and gravitation we put certain well-known glands we can explain the tropic part of our activity as readily as we can account for the movement of a moth in the presence of light.

In psychology the question is often asked: does muscular action precede or follow mental emotion? Both answers are in part right. If we act through what we have structure with which to act the action precedes the emotion. This is true in the main of conscious mechanical acts. But if we are in the grip of a subconscious forced movement emotion boils before action begins. This means that certain glands throw their content into the blood, and of the change we become conscious in a rising tide of emotion. Then we must act even if our conscious judgment tells us that action is vain. We must try to do the impossible and keep trying until the mechanism arises on which victory depends. The wish thus becomes will, but what will will do emotion cannot say. It is a law unto itself and may choose not to attain the wish but to suppress the emotion of which the wish is the visible representative.

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REFLECTIONS ON PROFESSOR PATTEN'S VIEWS.

I agree that the difficulties of language in a changing world of discourse are great, but I do not see that with all his good will, Professor Patten succeeds in avoiding the use of such terms as *ultimate, permanence, reality, original,* and *primary,* and I doubt if he can. The distinctions which they, or their equivalents, stand for have become almost a part of the structure of human thought. The mistake is only in taking them in any absolute sense. Some things are *more* ultimate or permanent or real or original or primary than other things—that is perhaps all we can say. A final ultimate, an absolutely-permanent, an unconditionally real, an original that has no manner of derivation, a primary that is not itself in some sense a secondary, may be a *Gedankending* entirely and no reality—though, on the other hand, I do not think we can say positively that it is, the exhaustion of the possibilities of being not being an easy attainment. But as I used the terms in my previous paper, I did not take them in a more than relative sense. Once after saying "fundamental" I added as an equivalent "more fundamental," and this was my implicit meaning all along the line. And in this relative sense I find Professor Patten himself using the terms in the present article, which I am glad to have been in any measure the means of provoking. He speaks, for instance, of the "return of the original in some more complex form," of structure as the "enduring element of a circuit," of "elements" of the universe in which there is no such thing as structure (surely akin then to "primary" forms of reality); he even refers to the "reality behind all" (as slowly altering), and of "the Growing, the Becoming" as "the Ultimate." I hardly think we differ in the principles of our use of language, however we may vary in their concrete and detailed application.

The most general conception which Professor Patten now offers is that of the order of existence as serial and even circular. The antecedents and consequents in a series are equally real (though some may be or become recessive)—the antecedent is no more original or ultimate than the consequent. The material (or physical) and the psychical are on the same plane, or if the material comes first and the psychical later, this does not mean that the material is more primordial in the world, but simply that it happens to appear first. When a blood illumination (I am not just

clear as to what this means, but no matter for the purpose in hand) occurs, and consciousness follows, that is not that the former causes the latter, but that there is a change, and these are the two terms of the change, the consciousness being quite as ultimate as the illumination of the blood, i. e., neither being really ultimate, language of this sort being, when strictly taken, irrelevant. The trouble is that we substantize what are only phases of a process, and after we have thus separated them we cannot easily get them together—hence a problem. As Professor Patten puts it, changes in the world are changes of form, not of substance. (Does not this imply, I may ask in passing, that the physical and psychical are of *one* substance? Or, in this view, is substance an irrelevant conception—a *mis*conception like that of the two substances or entities which Professor Patten repudiates?)

But this is only a part and not the most characteristic part of Professor Patten's conception. The order of existence is circular as well as serial. Professor Patten's illustration of an economic circuit—starting with the material, passing through the psychical, and returning to the material again, is very interesting, biographically and theoretically. The antecedent of thought here is food, but it is just as true that (more) food is the consequent of thought. The process does not run on indefinitely on one line, but returns on itself, and what is gained by the circuit becomes (or may become) the starting-point for a new circuit. Possibilities for indefinite progress in the course of the world's history seem thus to be opened—each circular series of changes enriching the world with a new result.

It is in the light of this general view that I must now regard the questions of my previous article. I understand Professor Patten a little better; do I find myself therefore satisfied? My prime question was as to the interpretation of energy, or pulses of energy. I thought I detected in Professor Patten's language the view, or suggestion of a view, that the inner meaning of a pulse of energy was a wish—or at least something of a psychical nature (in most cases when I speak of "wish" hereafter, I take the liberty, to avoid many words, of using the term in this representative sense as standing for the elemental, or more elemental, psychical forces in general). As I understand him now, the physical and psychical are not contemporaneous, one being manifestation, the other the reality manifested, but terms in a series, the physical coming first and the

psychical afterward or the psychical first and the physical afterward, according to the stage of the process which is had in mind. The physical (visible structure, for example) may be second in relation to wish, but the wish itself is second in relation to a pulse of energy—at least wish becomes *will* only as wish has created a structure which is the indispensable prerequisite of will. This is an intelligible view, and Professor Patten appears not to shrink from its uttermost consequences. Speaking of the universe at large, the "vital" elements, "energy and wish" (notice "vital," signifying I presume, that they are sources of change, in contrast with structure which tends to be stable—also "and", implying apparently that energy and wish are *two*, not one), are viewed as ever playing their part, giving birth to structure, the structure giving birth in turn to new and higher manifestations of themselves, and their earlier form being itself in turn conditioned by structure of a more rudimentary nature. "Each specific structure had a wish as its antecedent, but this specific wish also had a structure antecedent to it. . . . and so on *ad infinitum* without beginning or end".[1] That is, wish and energy, wish and structure too, are equally primordial (so far as the word is allowable) in the world, the difference being simply in the time of their manifestation and the degree of their complication. We have here the difficulty of an infinitely attenuated wish and an infinitesimal structure at one end (if there be an end) and of an infinitely organized wish and an infinitely complex structure at the other end (if there be another end), but the difficulty is one perhaps involved in all conceptions of an infinite series and need not detain us here.[2]

Professor Patten's ventures into the theological realm in this connection I will refer to only in passing. I am not particularly

[1] Professor Patten says, "It cannot be said that all wishes preceded structure nor that structure as a whole preceded wishes, but it can be said that before such structure was a wish and after it a new wish demanding new structure"—and no doubt he would equally say, "*Before* each wish was a structure and *before* that structure another wish and so on."

[2] I may remark here for the curious that another conception of the circular nature of reality was advanced by Nietzsche. The possibilities of progressive evolution are limited in his view, owing to the finite nature of the constituent forces of the world, and when the maximum point has been reached, disintegration sets in, chaos (lack of structure) returns, and in time a process of evolution begins over again. The course of existence is thus literally circular, while with all the circularity in Professor Patten's conception the course of existence *im grossen und ganzen* moves on in a straight line, and there is never an actual return to an earlier starting-point. In accordance with his view, Professor Patten thinks that all natural processes are synthetic, nature tending ever toward more complex forms (except where its forces are artificially isolated); but is this true? Is not disintegration or devolution and return to relative chaos as natural as movement toward higher organization?

interested—at least at present—in a "First Cause" and I am not sure that, if I were, I could find a substitute in "the Great Wish" or "Super-will." For the time being I tend rather to a pluralistic conception of the forces of the world. However, I agree that for me at least "the higher concept [because the only practically attainable one] of God is not that he is perfect, absolutely independent, and unknowable. He is due to a long series of circular processes just as our material world is." It is essentially the Nietzschean conception of the Divine (equivalent to Superhuman, Superman), which is a result of evolution, not its beginning. Nietzsche would also agree with Professor Patten when he speaks of "the Growing, the Becoming" as "the Ultimate" (only he would add to "the Growing," "the Diminishing, the Perishing"); in one passage he characterizes his view as an "inverted Platonism," saying that the further we get from "real Being" the better (i. e., theoretically, not necessarily practically).[3]

When, however, Professor Patten proceeds at this point to speak of what he suspects to be the real difference between his position and mine ("if there be one," as he courteously adds), he comes to the rub of the difficulty, i. e., my difficulty. "He seems to imply," says Professor Patten referring to me, "that the foreground—that of which we are directly conscious—is less than the content of the background; the latter being permanence, reality, and cause. To me the foreground and the background are on an equality." Now just what do I think? To explain fully would be going beyond the righteous limits of the present discussion, i. e., of my part in it; I am principally a learner here, desirous of getting another's point of view and only incidentally advancing a tentative view of my own. But I will say what I can say in a few words, saying it rather dogmatically perhaps, as Dr. Carus used sometimes to describe statements of his views, meaning only that he omitted the underlying reasons and also necessary qualifications. Professor Patten speaks of the "physical" as "unseen in consciousness." That is just the reverse of my way of thinking. By "physical" qualities I suppose we all mean—at least I mean—such things as heat and cold, sounds, sweet and sour, odor, color, resistance, hardness, pressure, weight, size, and the like; sometimes they are grouped in secondary and primary classes—but they are all alike physical. Now as I conceive matters, they are every one of them open to consciousness, directly experienced by consciousness; there is nothing occult or

[3] *Werke*, IX, 190; X, 160.

hidden about them. They are immediately felt—in fact, to separate them from feeling and make them into a world apart is a most problematical thing, if indeed it can have the dignity of being problematic at all. They are a part of experience, and independently of experience really mean nothing, are an *Unding*. Does a pain mean anything if it is not felt? As little does heat or weight mean anything if it is not felt. This is not saying that there is not something connected with the experiences that may not exist apart. We do not arbitrarily create them and cannot arbitrarily change them; somehow they are forced upon us and in just the specific shape they take. In given circumstances, I must experience red, must feel weight (I am now leaving abnormal conditions or dream phenomena out of account). But what is properly physical is feeling, somebody's (or something's) experience, all the same; separable from experience it is nothing. ("Consciousness," in the sense in which it has become something debatable in recent times—or may be even held to be non-existent—may not be necessary to the physical, but the germ, or germs, out of which consciousness—if it exists—develops, namely, feeling, is. Consciousness, in the proper and perhaps only legitimate sense, is attention, and this is a secondary thing in psychical life.)

And yet when I reflect at all about the matter, I see that colors, sounds, odors, resistances, weights, etc., are evanescent phenomena—they are feelings, experiences, coming and going; there is no steady, constant red and no steady, constant weight—indeed, such experiences would be intolerable, and inconsistent with the practical necessities of life. The world that stretches out beyond [and includes] our bodies is a world of our imagination or thought rather than one of actual immediate experience—we picture and spread out a panorama of what we *have* experienced or other people have experienced, or of what we think we or others *might* experience. We customarily think of this largely possible world as an actually existent and relatively constant thing; but it is in good measure neither actual nor constant, if experience is an inseparable part of it, for experience, as we humans have it at least, is momentary and fragmentary. We are thus driven, or at least led, to go out beyond the circle of our feelings if we want something that is anywise abiding. Yes, and a deeper impulse still seems to be at work. For with such minds as have at last come to us in the course of evolution, we incline to look for an explanation of anything that

suddenly arises and then passes away; we think it must come from somewhere, must have some ground or reason for being (however momentary may be the being, and all the more indeed just because it is momentary)—that is, we look for the agents or factors that produce it, and produce it in just the particular definite shape and outline that it has. If we could produce heat and cold, sound and color, resistance and weight at will, all would be different—it might be a world, but it would not be our present world, in which arbitrary will or thought or fancy or imagination do nothing—they cannot of themselves give birth to a single sensation. Hence, if *we* do not do the work, somebody or something else must—supposing that there is any sense in reasoning at all. We are led then, I say, to conceive of agents beyond ourselves in order to account for what happens to us, i. e., our experiences,—agents or factors that condition them, explain them, cause them, or are responsible for them, whatever the form of speech we may prefer. In short, we must go out of the world of experience to account for the fact that we have experience—or at least this very particular and definite kind of experience of which I am now speaking; something or somethings, we reason, lie behind it or beyond it or above it or below it—whichever preposition we choose.

Now this point of view I judge that Professor Patten does not share, and here I think is the primary ground for our difference, as far as it exists. To me the foreground of thought and its background (these words interpreted as above) are not on an equality. I believe—perhaps I cannot say more than "believe"—that what gives me feelings of sweet or heat or sound or weight is or may be more permanent than sweet or heat or sound or weight itself, that it may be very little if at all affected by the fact that it works these changes in me, that it is to this extent an independently real and would exist just the same whether I were on hand to be affected by it or not. The physical is thus most decidedly a secondary phenomenon or fact in the world. It is known directly, but it is not self-sufficient, or stable, or anything but a revelation (perhaps ultimately for practical purposes) of forces or agents behind it. These forces or agents may not be indeed themselves stable or self-sufficient, they may be conditioned or determined by something beyond them, but they are at least more stable and self-sufficient than the passing experiences they give rise to in us; for example, what gives me the sense of weight to-day may have given me the

same sensation ten years ago, and might have any day in between; in other words, it was there, and relatively unchanging, though I had no experience from it whatever in the intervening time and though conceivably no one else had experienced it during that time either; in short, it is in common parlance, a more permanent thing, a more real thing, more nearly an ultimate thing than the momentary accidental effects it has had on me.

A query then arises as to how we are to think of these metempirical (meta-physical, super- or sub-sensible—they are all equivalent expressions) forces or agents. Now it was because I thought I found the suggestion of an answer that I was so interested in Professor Patten's first article. He spoke of pulses of energy rising, e. g., on the surface of an ameba, and sinking back and reappearing at some other point of the surface. These are, as I should say, *physical* phenomena, my (or somebody's) observation, or experience, resolvable at last into shades of color, with their varying outlines, degrees of resistance, with their varying extent or size, and so on. But the interesting thing was that Professor Patten seemed to give a certain ***interpretation*** of them. He spoke of them as "a wish striving for fulfilment," although "objectively considered" they were "a series of surface projections created by a passing pulse of energy." He characterized them formally as "*on their physical side* surplus discharges" (italics mine). That is, there was by implication another side, and an interior view of the physical phenomena was suggested. The view seemed hardly to be held to quite consistently, but it was there, and I strove to see if by interpretation consistency could be made out—hence my little paper. But now I see that Professor Patten did not quite mean what I thought or hoped he did. Wishes or will and energy or structure are not, in his view, inside and outside of the same reality, absolutely coexistent and contemporaneous (supposing an observer is on hand), but *successive* things, now one, now the other in evidence, all quite on a par so far as their existential quality is concerned, no one being more primitive and primordial than another. The view is still extremely interesting, and far and away ahead of the ordinary materialistic view, according to which the psychical is the outcome or product of the physical; still it does not satisfy me—at bottom, I suppose, because I hold to what I hope I shall not confuse the reader by calling an ***idealistic*** interpretation of the physical, while he holds to the realistic or common-

sense view (ultimately, I should add, I am just as realistic as he).[4] All the same, I am profoundly indebted to him for his vigorous and keen vindication of the shaping influence which the psychical may have on the physical, though I might state the influence in terms which he would not approve (see the close of my previous article).

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I may add two or three minor comments, though I fear I have already exceeded the limits of space allowable to me. Professor Patten says that though the growth of structure is the growth of the universe, "yet in its elements there is no such thing as structure. All is flow, transformation, substitution—a fickle mass made coherent by something that comes from it but is not of it." But do not wishes belong to those elements, and are not wishes ever creating structure or tending to? Indeed, must not structure in some infinitesimal form at least always belong to the universe, if wishes are at work?

The developments of Professor Patten's distinction between wish and will now made by him interest me, and I recognize their validity within limits, though I might use different language—I will not undertake to discuss them now. However, in answer to his express question, "Would he rather be permanent than influential?" I will say that I certainly hope that I should be great enough to prefer survival in the form of an impersonal influence (supposing there was something of worth in me) than in the form of my present most finite self—or, to use Professor Patten's phraseology, I should rather be "influential" than "permanent." Is there not a suggestion of a similar idea in the saying attributed to Jesus, "Except a corn of wheat fall into the ground and die, it abideth alone; but if it die, it bringeth forth much fruit," and still more distinctly in such language as "It is expedient for you that I go away, for if I go not away, the Comforter [elsewhere described as leading into all truth] will not come to you" (John xii. 24; xvi. 7).

Nothing could be happier than what is said of tropic and instinctive action. I think there is no gainsaying the fact that in instinctive actions the tropic tendencies are still there; but would Professor Patten say that in the antecedent purely tropic movements, the instinctive tendencies were there? Perhaps not—surely they

[4] If idealism is, as it is sometimes regarded, the doctrine that "the act of knowing constitutes, creates, or modifies the things known, with the result that the entire world, in so far as it is knowable, is indissolubly bound up with the reality of a mind, or minds," then I completely dissent from it.

are not discoverable—but if they are not in any sense there, how do they ever come to be, and, when they come, are they not an outright creation? If, on the other hand, we say that tropism itself is essentially (interiorly) psychic, the difficulty vanishes—or at least diminishes. In other words, does the "complex unit," of whose evolution Professor Patten speaks, *become* complex, or is it in germ and possibility complex from the start, the possibility passing from a state of δύναμις to one of ἐνέργεια? More briefly still, are there ever tropisms "determined solely by objective conditions" (as Professor Patten supposes), save as one psychic tendency may be more determining, stronger, than another? Professor Patten once speaks of factors in a synthetic process, which are "active, even if incapable of observation"—may not this language have a wide application? May not factors, indeed, be *in*active and yet truly exist, or, to speak more correctly, may there not be elements in, or bound up with, a synthetic process which have to wait for time and occasion to become *factors* at all?

Professor Patten says that wish is not the *cause* of structure, but merely the antecedent. None the less, he uses the words "influence," "modify," "action," "mould." If he had said "does not *create*" (in the old sense), *originate*, I could understand. He even goes so far as to speak of wishes in this connection as "indexes" (of the pressure exerted by underlying, as yet non-structural forces) rather than anything else, but if they do not effect something, what is the occasion for them, what is their use, why in the economy of nature may they not be spared? And, after all, does cause *mean* anything more than that which effects?

Professor Patten still continues to use language at times, noticeably at the close of his present article, which suggests the view that the physical is the more primary or original thing, the wish being simply a reflection or index or representation of it—not quite epiphenomenal, indeed, for it can in turn effect something in the physical realm, but still secondary. According to my view, or at least the view I am now interested in suggesting, it is always primary (i. e., *more* primary than the physical). A wish need not be conscious, i. e., attended to by anybody, may be a mere tendency or impulse, representable physically as a blind movement, and yet be real, indeed the substance of what appears as movement to us.

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THE CRIB OF CHRIST.

The crib of Christ, which was set up in the churches at Christmas, contained figures of the Holy Family as well as an ox and an ass. The congregations danced around it, singing carols.[1] This singing and dancing was a survival of the pagan ritual of the feast of the winter solstice, which the Church could not abolish.[2] The first Christmas crib is said to have been set up by St. Francis of Assisi in 1223.[3]

Hermann Usener has shown that the 25th of December was not observed as the feast of the Nativity before 354 A. D.[4] In his article on the Nativity narratives in the *Encyclopædia Biblica* (col. 3344, § 6), he says that the addition of an ox and ass to the manger is due to popular imagination, partly influenced by the liturgy;[5] but we read in the Gospel of Pseudo-Matthew,[6] which may have been

[1] The last lines of the old *Dreikönigslied* in the "Kinderlieder" appended to *Des Knaben Wunderhorn* are: "Es waren da zwei unvernünftige Tier', | Sie fielen nieder auf ihre Knie. | Das Oechselein und das Eselein, | Die kannten Gott den Herren rein. | Amen." The last stanza of *Christkindleins Wiegenlied* begins: "Schweig, Eselein, still, | Das Kind schlafen will, | Ei Oechsle nicht brüll', | Das Kind schlafen will." In the third stanza of a *Wiegenlied* we have: "Eya! Eya! schweig, du trautes Kindelein, | Es beisst dich sonst ein Eselein, | Und stösst dich Josephs Oechselein zu Bethlehem." See Eduard Grisebach's new edition of *Des Knaben Wunderhorn* (Leipsic, 1906), pp. 835-837; cf. Haupt, *Biblische Liebeslieder* (Leipsic, 1907), p. li, note 59.

[2] See Haupt, *Purim* (Leipsic, 1906), p. 11, line 11.

[3] See *Encyclopædia Britannica*, 11th ed., Vol. 5, p. 379b.

[4] See Lagarde, *Mitteilungen*, Vol. 4 (Göttingen, 1891), p. 311; cf. *Encyclopædia Britannica*, 11th ed., Vol. 6, p. 293.

[5] It may have been suggested by Luke xiii. 15 where we find ox and ass in connection with *phâtne*; but the fact that *phâtne* means *manger* in Luke xiii. 15 does not prove that it has the same meaning in Luke ii. 7, 12, 16; the first two chapters of the Third Gospel were not written by St. Luke; see the beginning of my paper "The Child in Luke i. 76," in *The Monist*, April, 1919.

[6] The *Evangelium Pseudo-Matthaei* (Chapter XIV) says: "Tertio autem die nativitatis Domini egressa est beata Maria de spelunca, et ingressa est stabulum, et posuit puerum in presepio, et bos et asinus adorabant eum. Tunc adimpletum est quod dictum est per Isaiam prophetam dicentem: Cognovit bos possessorem suum, et asinus presepe domini sui. Ipsa enim animalia, scilicet asinus et bos, in medio eum habentes incessanter adorabant eum. Tunc adimpletum est quod dictum est per Habacuc prophetam dicentem: In medio duorum animalium innotesceris." See J. C. Thilo, *Codex Apocryphus Novi Testamenti* (Leipsic, 1832), p. 384; cf. Tischendorf's edition in his *Evangelia Apocrypha*, 2d ed. (Leipsic, 1876), and the translation in K. F. Borberg, *Die apokryphischen Evangelien und Apostelgeschichten* (Stuttgart, 1841), p. 268; also E. Hennecke, *Neutestamentliche Apokryphen* (Tübingen, 1904), p. 25* and p. 47. Thilo calls the Gospel of Pseudo-Matthew *Historia de nativi-*

compiled about 350, that when Mary placed the Babe in the manger, ox and ass worshiped Him,[7] thus fulfilling the prophecies of Is. i. 3 (*The ox minds its owner, and the ass its master*)[8] and Hab. iii. 2, where we find in the Greek Bible for Heb. *bĕ-qĕrb shanîm ḥayyéhû,* which is supposed to mean *In the midst of the years revive it,* the rendering *en méso dyo zóon gnosthése,*[9] followed by a second interpretation of this clause: *en to engizein ta éte gnosthése.*[10] This second rendering was adopted by J. D. Michaelis who translated in 1782: *wenn die Jahre herankommen,* when the years approach.

The reading *bi-qĕrób* is undoubtedly better than the *bĕ-qĕrb* of the received text; *qĕrôb,* however, is not the infinitive construct of the verb *qaráb,* to approach, but the construct state of a substantive *qarôb,* approach, proximity, nearness, which appears in Arabic as *qarâb.*[11] In Ezek. vii. 8 we have *miq-qarôb,* shortly, soon.

tate Mariae et infantia Salvatoris, but in the oldest manuscript it is entitled *Liber de ortu beatae Mariae et infantia Salvatoris a beato Matthaeo evangelista Hebraice scriptus et a beato Hieronymo presbytero in Latinum translatus;* see Holtzmann, *Einleitung in das Neue Testament,* 2d ed. (Freiburg i. B., 1886),p. 540; cf. Hauck's *Realencyklopädie für protestantische Theologie und Kirche,* 3d ed., Vol. 1 (Leipsic, 1896), p. 656, line 48; Vol. 13 (Leipsic, 1903), p. 313; *Encyclopædia Britannica,* 11th ed., Vol. 2, p. 179b; Vol. 17, pp. 812a and 814a; Hastings, *Dictionary of the Bible,* Vol. 2, p. 776, note *.

[7] Cf. Hastings, *Dictionary of the Bible,* Vol. 3, p. 288b, line 5.

[8] *Crib* is a gloss; the meter is 2 + 2.

[9] The view that this is a patristic interpolation (see *The Open Court,* No. 706, p. 191) is unwarranted; cf. also the conclusion of Dr. Rudwin's paper *Die Prophetensprüche und -zitate im religiösen Drama des Mittelalters* in Vol. 50, Part 3, of *Saat auf Hoffnung* (Leipsic, 1913).

[10] The doublets in the Greek Version have been explained by Louis Cappel; see the quotation in Laur. Reinke, *Der Prophet Habakuk* (Brixen, 1870), p. 133. Happel, *Das Buch des Propheten Habackuk* (Würzburg, 1900), p. 47, remarks: "Unter den beiden Tieren verstand S. Hier[onymus] und S. Aug[ustinus] nach Zach. 9, 9: Matt. 21, 2-7 [contrast *Journal of Biblical Literature,* Vol. 35, p. 288] die Juden- und Heidenkirche oder die beiden Testamente. Die Beziehung auf Ochs und Esel an der Krippe des Herrn, die zuerst im Evang. Ps. Matthäi [cf. above, note 6] genannt werden, wird fälschlich Orig[enes], Ambros[ius], Gregor[ius] Nyss[enus, i. e., St. Gregory of Nyssa, c. 331-396] zugeschrieben," with the reference: "Knabenb. l. c. p. 96," i. e., *Commentarius in Prophetas Minores auctore J. Knabenbauer,* Parisiis, 1886. Geo. A. Smith, *The Book of the Twelve Prophets* (London, 1898), Vol. 2, p. 157, refers to St. Augustine's exposition of the Septuagintal version of this Psalm in *De Civitate Dei,* XVIII, 32.

[11] There is no evidence that there was a noun *qorb,* proximity, in Hebrew, although we have *qúrbâ* in Syriac, and *qurb* in Arabic. For French *prochainement,* German *nächstens,* we find in Syriac: *bĕ-qúrbâ* or *min-qúrbâ;* but also *qĕrâbâ* (which means, as a rule, *war,* originally *approach,* attack) signifies *nearness* (like *qarrîbûthâ* or *mithqarbânûthâ*). For Syr. *min-qúrbâ* we have in Arabic: *'an-qarîbin* or *'an-qúrbin,* and in addition to *qurb,* nearness (in place, time, or relation), we have also *qarâb,* which appears in Hebrew as *qarôb.* In Ethiopic we find *qĕrâba* or *ba-qĕrâb,* near.

We can just as well say *bĕ-qarôb*. The phrase *bi-qĕrôb shanîm* means literally *in the nextness of years*, i. e., *in the next* (few) *years*.[12] In German you say for *in the next* (few) *days* either *in den nächsten Tagen* or *nächster Tage*. The clause *bĕ-qérb shanîm ḥayyéhû*, revive it in the midst of the years, is meaningless, and even if we read *bĕ-qérb shĕnáim* (or *shĕnê*) *ḥayyîm*, this could not mean *in medio duorum animalium*.[13] Heb. *ḥayyîm* signifies *vivi*, not *animalia*, and *duo animalia* would be *shtáim* (or *shtê*) *ḥayyôth*; but ox and ass would not be called *ḥayyôth*, which denotes *wild beasts*, and while we might say *bĕ-qérb ḥayyôth rabbôth*, in the midst of many beasts, we should expect *bên shtê ḥayyôth*, between two beasts. If a Hebrew writer wanted to say that bezoar-stones had been found in the stomach of two wild goats, he might use the phrase *bĕ-qérb shtáim ḥayyôth*.

Louis Cappel (1650) suggested reading *ḥawwéhû*, indicate it, instead of *ḥayyéhû*, revive it. The clause *bi-qĕrôb shanîm ḥawwéhû* is a gloss (or variant) to *bi-qĕrôb shanîm tôdî'*, but instead of *tôdî'* we must read the passive *tiwwadé'*. The couplet prefixed to the Maccabean psalm in the third chapter of the Book of Habakkuk should be restored as follows:

Yahwê shamá'tî shim'éka — *wĕ-ra'ithî ĕlôhái pŏ'léka*
[a] *Bi-qĕrôb shanîm tiwwadé'* — *bi-rógz raḥḥém tizkór.*

(a) *bi-qĕrôb shanîm hawwéhû*

O JHVH, I heard of Thy fame, — I shall see, O my God, Thy work.
[a] Thou'lt manifest Thyself in the near future, — in wrath Thou'lt remember mercy.

(a) indicate it in the near future

This couplet should be followed by verses 15, 16. The *sea* and the *foam of the waters*, into which JHVH is to drive His steeds,

[12] See Gesenius-Kautzsch, *Hebrew Grammar* (Oxford, 1898), § 128, r.

[13] Grotius (1644) remarks ad Hab. iii. 2: "Graeci pro *shanîm* (annorum) legerunt hoc loco *hayyîm*; vertunt enim *en méso dyo zóon*, in medio duorum animalium, quod illi videntur intellexisse de illis coelestibus Potestatibus quae *hayyôth*, Animalia, apud Ezechielem. Quam variis modis Christiani haec sint interpretati vide Hieronymum." J. C. Doederlein adds in his edition of Grotius's *Annotationes* (1776): "Legerunt potius *shĕnê hayyîm*." According to G. J. L. Vogel, *in medio annorum* means *in nostra aetate* (contrast *bĕ-'aḥrîth hash-shanîm*, in the latter years, Ezek. xxxviii. 8). *Bĕ-qérb shanîm*, however, cannot have this meaning, although Syr. *qarrîbê* denotes *those of the present age*, the adjective *qarrîb* signifying not only *near*, but also *contemporary*. We use *proximo* for the next or the coming month.

denote the Syrian persecution.[14] The poet hopes that JHVH's wrath (cf. 1 Macc. i. 64) will be appeased in the near future. The interpretation given in the Evangelium Pseudo-Matthaei, *in medio duorum animalium innotesceris*, is impossible; there is no reference to ox and ass or any other two animals in this passage of the Book of Habakkuk.

Nor did Mary place the Babe in a manger; *phátne* in Luke ii. 7, 12, 16 denotes one of the recesses in front of the travelers' chambers[15] along the interior court of a caravansary.[16] Shakespeare uses *crib* in the sense of *small chamber*, small lodging or habitation (cf. the use of *box* for a small country-house): at the beginning of the third act of the second part of *Henry IV* (lines 11, 14) the King apostrophizes Sleep:

> "Why rather liest thou in smoky cribs....
> Than in the perfum'd chambers of the great?"

We may therefore render *phátne* in Luke ii. 7 by *crib*. The primary connotation of *phátne* is *hollow* or *cavity*. Diodorus Siculus (I, 66, 4) uses *phátnai* for *lacunars*, i. e., sunk compartments of a coffered ceiling. *Phátne* is a doublet of *páthne* (cf. *kithón* = *chitón*) which may be connected with Greek *bóthros* and Lat. *fossa*. The corresponding Hebrew word is *rahîṭ*. In Arabic, *rúhatah* or *rúhaṭâ'* is synonymous with *qâçi'â'*, burrow of a jerboa. The Greek Bible has *phátnoma* for Heb. *rahîṭ* in Cant. i. 17;[17] we find this word also in 2 Macc. i. 16 where *he tou phatnómatos kryptè thyra* denotes the trap-door of the paneled ceiling (not *the privy door of the roof*, as the Authorized Version renders). *Phatnómata* is used also for *port-holes* or *loopholes*[18] in the sides of a ship and for the sockets

[14] Cf. the explanation of the Maccabean psalm in the second chapter of the book of Jonah in my paper "Jonah's Whale" on p. 163 of the *Proceedings of the American Philosophical Society*, April 20, 1907 (Vol. 46). See also *American Journal of Semitic Languages*, Vol. 23, p. 258, note 3.

[15] See *Encyclopædia Biblica*, col. 2170, line 46; contrast col. 2171, line 27; Hastings, *Dictionary of the Bible*, Vol. 3, p. 234b.

[16] A good many first-cabin passengers, who went from Marseilles to Algiers on April 17, 1905, to attend the Fourteenth International Congress of Orientalists, had to sleep on mattresses in the corridors between the state-rooms, because the steamer ("Général Chanzy") was overcrowded.

[17] Cf. Haupt, *Biblische Liebeslieder* (Leipsic, 1907), p. 63, note * and p. 124.

[18] In Zeph. ii. 14 the Septuagintal *phatnómata* may denote *recesses* in the walls; cf. my remarks in the *Journal of the Society for Oriental Research*, Vol. 1, p. 4. The Hebrew original has *kaftôr*, capital of a column; but the Ancient Versions did not understand this word: the Vulgate has *limen*; the Targum: *pittûh târ'â*, sculptures of the door; the Peshita: *bâttê*, houses. The Authorized Version renders: *upper lintels*; the Revised Version: *chapiters*.

(*alveoli*) of the teeth. *Alveolus* signifies not only a *trough* or basin, but any small hollow or cavity.

There is a very early tradition that Jesus was born in a cave near Bethlehem. Many khans have caverns below them where cattle are sheltered. The traditional scene of the Nativity is a grotto on the eastern part of the lime ridge on which Bethlehem is situated. A basilica was built over it by the emperor Constantine in 330. C. R. Conder says that in the Hebron hills there are many rock-cut stables for cattle, which resemble the cave under the choir of the basilica at Bethlehem.[19]

The Jewish-Christian legend of the Nativity states in Luke ii. 7 that Mary laid the Babe in a *phátne*, because there was no room in the *katályma*. In Mark xiv. 14, Luke xxii. 11 *katályma* denotes the dining-room (Greek *anágaion*) where Jesus wanted to celebrate the Passover with His disciples. The Vulgate has *diversorium* in Luke xxii. 11, but *refectio* in Mark xiv. 14.[20] In 1 Sam. ix. 22 the Greek Bible uses *katályma* for Heb. *lishkâ* which has passed into Greek as *lésche*. Heb. *lishkâ* denotes a *banquet-hall* for sacrificial feasts like the Assyrian *bît akîti*.[21] These halls were used not only for banquets, but also as inns.[22] A synonym of *lishkâ* is *bêth-léḥem*, eating-house. Heb. *léḥem* signifies not only *bread*, but also *food*, repast, feast. The edifice which Samson pulled down was a *bêth-léḥem*. In 1 Sam. xx. 8 *bêth-léḥem* denotes a *banquet-house* in which David wanted to celebrate the New Year with his clan, and in 2 Sam. xxiii. 15 *bêth-léḥem* refers to the *mess-hall* in the camp of the Philistines in the Valley of Rephaim.[23] There are no springs at Bethlehem; the Masoretic text reads therefore in 2 Sam. xxiii. 15 *bôr*, cistern, instead of *bêr*, spring.

The name Beth-lehem, which is generally supposed to mean House of Bread,[24] does not allude to the fertility of the neighbor-

[19] See Hastings, *Dictionary of the Bible*, Vol. 1, p. 281a; Vol. 3, p. 235a. In Saxon Switzerland there is a cave known as the *Kuhstall* (cow-stable). The peasants are said to have sheltered their cattle there during the Thirty Years' War.

[20] Contrast Hastings, *Dictionary of the Bible*, Vol. 2, p. 474b.

[21] See note 89 to my paper, "Was David an Aryan?" in No. 753 of *The Open Court* (February, 1919), p. 89.

[22] Cf. *Odyssey*, XVIII, 328, and *Encyclopædia Biblica*, col. 721, note 1.

[23] See p. 90 of my paper cited above, in note 21.

[24] Nor does the second element of the name represent the god Lakhmu mentioned in the first fragment of the cuneiform Creation tablets; cf. R. W. Rogers, *The Religion of Babylonia and Assyria, Especially in Its Relations to Israel* (New York, 1908), p. 108; Zimmern on p. 214 of the *Hommel-Festschrift* in *Mitteilungen der Vorderasiatischen Gesellschaft* (Berlin, 1916).

hood, but is derived from an ancient hospice or hostelry (Heb. *gerûth*, from *ger*, stranger) near Bethlehem,[25] on the highroad from Jerusalem to Hebron, which is mentioned in Jer. xli. 17.[26] The Authorized Version renders: *the habitation of Chimham*; the Revised Version has *Geruth Chimham*, and in the margin: *the lodging-place of Chimham*. This ancient caravansary may have been founded by Chimham ben-Barzillai who followed David to Jerusalem when the aged Barzillai declined the invitation of the king (2 Sam. xix. 38).[27] Bethlehem, therefore, is a name like the Persian *Khawarnaq*, which is connected with the verb *khordân*, to eat, or the German *Wurmlage*[28] which is used in old German chivalric poems for a place where banquets and knightly tilts, justs and tournaments are held. Khawarnaq near Hîra[29] was a large square building with a spacious court in the center, like a caravansary.[30] In the Talmud this Persian word appears as *akhwarnĕqâ*, which denotes a dining-hall.[31] Hîra was situated in the extraordinarily fertile boundary-land between the Euphrates and the Arabian Desert, a few miles south of Kûfa near Lake Nâjaf.[32] The court of the Lakhmid kings at Hîra, famed in Arabian history and literature, was the most celebrated center in pre-Islamic Arabia, where, in the century preceding the appearance of Mohammed, poets from the whole of North Arabia were wont to assemble.[33] The castle of Khawarnaq

[25] Caravansaries are generally built in the neighborhood of a town or village, whereas khans, which provide both lodging and food, are located within the precincts of a town. The *lodging-place of wayfaring men* in the wilderness (Jer. ix. 2) does not refer to a caravansary (contrast Hauck's encyclopedia, cited above, at the end of note 6, Vol. 6, p. 264, line 54): for *ôrĕhîm*, wayfarers, we must read *ahrôn*, extreme, outermost; the Greek Bible has *stathmòs éschatos*.

[26] Contrast *Encyclopædia Biblica*, col. 2171, line 17.

[27] See note 91 to my paper cited above, note 21; cf. Hauck's encyclopedia, cited above, at the end of note 6, Vol. 2, p. 667, line 15.

[28] There is a place called *Wormlage* near Kalau in the district of Frankfort-on-Oder. *Wormlage* means *lair of a worm*, i. e., dragon. Cf. the place-names Drachenfels, Löwenberg, Löwenstein, Wolfstein, Wolfsberg, Wolfhagen, Wolfsanger, etc.

[29] See Haupt, *Biblische Liebeslieder* (Leipsic, 1907), p. 119.

[30] See the cuts on pp. 815a and 3281b of the *Century Dictionary* and p. 278 of the *Calwer Bibellexikon* (Calw, 1912). A ground-plan of Khawarnaq is given on p. 19 of B. Meissner, *Von Babylon nach den Ruinen von Hira und Huarnaq* (Leipsic, 1901).

[31] See Lazarus Goldschmidt, *Der babylonische Talmud*, Vol. 2, p. 86; Vol. 3, pp. 452, 547 (Berlin, 1901, 1899).

[32] Cf. *Journal of the American Oriental Society*, Vol. 32, p. 1.

[33] Cf. *Encyclopædia Britannica*, 11th ed., Vol. 18, p. 644a.

is said to have been built by a Roman architect, Sinimmâr, who was hurled from the building because he told the last king of Hira, an-Nu'mân, the son of al-Mundhir (580-602 A. D.), that he might have constructed a superior edifice. The *reward of Sinimmâr* is repeatedly referred to in Arabic poetry.[29] The famous architect is alluded to also in a Turkish inscription found in Galicia.[34] Sinimmâr may be an ancient Babylonian name.[29]

The name Bethlehem does not mean House of Bread, but House of Bait, i. e., halt for refreshment. The original meaning of *to bait* is *to cause to bite*, and Heb. *lishkâ*, Greek *lésche*, is a modification of Heb. *nishkâ* from *nashák*, to bite. The inn at Bethlehem, in which Jesus is said to have been born, may be the hostelry mentioned in Jer. xli. 17.[35] As there was no room for them in the inn, Mary laid her firstborn son in one of the recesses in front of the travelers' chambers along the sides of the interior court of the caravansary.[36] This antechamber may be called a *crib*, but it was not a stable, nor was the Babe placed in a manger. Neither David nor any of his descendants was born at Bethlehem: David's early home was in the neighborhood of Hebron, and Jesus, who was not a son of David, was born at Nazareth.[37]

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[34] See H. L. Fleischer, *Kleinere Schriften*, Vol. 3, p. 611 (Leipsic, 1888).

[35] If Jesus was born in that inn, its location must have been near the road from Jerusalem to Hebron, in the neighborhood of the modern hospital of the Sisters of Charity, not on the site occupied by the Church of the Nativity in the southeastern corner of the village.

[36] These recesses or arcades (cf. above, note 15) resemble the cloisters, or covered ambulatories, in some of the colleges of Oxford and Cambridge or in some of the buildings of Bryn Mawr College (cf. above, note 30). The famous *bambino* in the Church of *Ara Coeli* in Rome stands in a tub set upright, so that this manger resembles a niche or recess in a wall; see the cut in the *Century Dictionary*, p. 435.

[37] See my paper "The Aryan Ancestry of Jesus," in No. 635 (April, 1909) in No. 753 (February, 1919) of *The Open Court*. See also *Johns Hopkins University Circular*, N. 316, pp. 4, 20.

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PHILIP E. B. JOURDAIN.
(1879-1919.)

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THE MONIST

PHILIP EDWARD BERTRAND JOURDAIN.

THIS journal has suffered another great loss in the death, on October 1, 1919, of Mr. P. E. B. Jourdain, M.A., who has been the English Editor of *The Monist* since 1912. Following so soon on the death of Dr. Paul Carus this loss is especially felt. Certain aspects of Mr. Jourdain's work will be familiar to all our readers; but his genial personality, the extraordinary breadth of his interests, and the humorous kindliness which endeared him to all his friends, it is more difficult to convey to those who had not the good fortune of his personal acquaintance. It will, however, be our duty in this notice to try to give some impression, slight and incomplete though it may be, of the man himself and of his work.

Mr. Jourdain was born on October 16, 1879, and comes of a distinguished family possessing, as the name implies, French antecedents. He was the youngest son of the late Rev. F. Jourdain, Vicar of Ashbourne, Derbyshire. Even before he went to school he showed that characteristic interest in the strictly logical interpretation of ordinary speech which was the foundation of his mature wit; and in his school-days at Cheltenham College he soon developed the combined interest in mathematics and science which was to decide the main trend of his thought. I have been privileged to see the exceedingly interesting memories of these earlier years which have been so charmingly set down

by his youngest sister Milly. These memories not only picture with evident truth the characteristics which were to make the man, but also possess in themselves intrinsic value. With Miss Jourdain's permission certain parts of them are here given.

Among the cold, green Derbyshire hills the river Dove flows swiftly through its dales—valleys of steep, grass-grown hills and sharp, gray limestone rock. Sometimes masses of bushes and small trees grow near the water; the cold mist blows there in the winter, and even in the summer it is green and cool. When the river has left the dale it passes through tamer country, by flat fields and under old country bridges of graystone, till it comes to another exciting place, a rushing weir. The swiftness and noise with which the water slid down the weir-bank and into the green depths below had a great fascination for me, and yet I was so frightened of it; as if all the river's evil spirits were shouting and yet could not get free. About a mile from this river, in a gabled graystone house on a hill overlooking the market-town which lay along the next valley, Philip and I were born and lived for more than our childhood. Water was always so important to me, and to him too I think, so that we could hardly rest till we had seen the river or the sea in any new place, as if any water had a living connection with our river.

The garden, which was on the hillside all round the house, was of course the most friendly and familiar place to us both. I do not know if an outsider would have found it so interesting: there were stretches of rough grass—set for hay in the Spring—with pines, and yews, and deodars planted here and there; a sloping mown lawn in front of the house, a big kitchen garden at the back, and by the side a friendly bit of mixed wood where there was a swing and piles of wood and fowl-houses. It was here that we used to build huts round the trunks of trees with branches pulled from the piles. Philip told me one day that he had found some planks left over from building a wood-shed, so we went there when the gardener was out of the way and silently carried them off to our hut-making place. We pretended we were travelers shipwrecked on a tropical island, and this game lasted through many summer holidays —we hunted wild beasts on half-tamed zebras, and when the dinner

bell rang and we ran indoors we sat at the table breathless and quiet, anxiously waiting for the moment when we could rush off and Real Life begin again. At the bottom of all was a tennis lawn, a flat mown place like a lake among the rough grass banks with evergreens dotted about them.

We both had our own gardens up at the back of the house. They were in a shady place, especially mine, and nothing much grew there but two stick-like plum-trees, grown from stones, and some lung-wort. Philip's was in rather a better position, but he took no interest at all in any plant, so here again there were patches of lung-wort. We used it as a graveyard for any stray dead animals, such as ducklings and mice. There was still a space in his garden, and he suggested that we should dig till we came to the middle of the earth and see if it was burning hot. So we dug down about a foot; then I got in and said excitedly that I could *feel* it getting warm, but when Philip got in he felt no difference, and our enthusiasm for digging soon failed.

Later on we had better gardens near the front of the house, where there was more sun and the ground seemed better. We both liked the gardener, though he found Philip's wits rather too sharp to live with comfortably; but once I remember William got the best of an argument. William was a misogynist and Philip said: "But William, if people didn't marry, there'd be no children."

"There's enough children to last *our* time, Master Phil," said William and went on digging.

If we went down the field-path and through the churchyard we came to the road over the stone bridge. This was where I liked to run on in front and hang over the side, watching the muddy stream below until whoever was with me came up. Then we passed the little, wooden toy-shop, a lovely place full of cheap toys, dogs and common dolls, wooden horses with cylindrical bodies and many penny toys, fascinating to look at even if you had no money to spend. The old man who kept this shop had a long, gray beard, and a black velvet skull cap—enough to make me think him a magican. He was a clever old man, much interested in photography and a friend of Philip's. When Philip went into the little room behind the shop —where there was a skylight and a big stand-camera and artificial backgrounds for taking portraits—to talk to the old man, I would have a thorough inspection of the toys. This was the only shop before we came to the station—a delightful place to explore with

Philip. I used to follow Philip into the signal-box and even on to an engine and listen to his friendly technical talk without understanding a word; but it was enough to feel how popular he was and to see the grizzled old engine-driver looking at him with much affection. There was a great stone shed where the railway lines went into the darkness; engines went in there like tired animals after the day's work was done, and I thought they must have a jolly time in their house.

The beginning of the town was fine, the huge church with much ground round it, so that no other building could come too near, stood facing the wide street; the gray Elizabethan grammar-school on one side, a raised, cobbled pavement in front of it, and on the other side solid dwelling-houses, in one of which Dr. Johnston used to stay. There was a wonderful feeling of brightness in the light here, perhaps because I always think of it on a fine day—and the inside of the church always seemed to me brighter than any other church. The street grew narrower as we went on and the shops crowded together, but there were curious old bits—the queer cobbled way up the hill to the market, and the sign of the inn stretching like an arch across the road with a Turk's head on the top and the picture of a sportsman in a green coat hanging below.

At the end of this long street there was a big house with grass laid round it, old enough to be haunted but not otherwise interesting. Philip and I once stayed here, and though we saw no ghost I was much afraid at night, for my room was on a higher floor than his and the people all seemed grown-up and remote. I had a bath in my room at night and I dragged it up behind me for protection when I knelt to say my prayers, thinking that the ghost might at least fall in the water first.

It was September just before Philip went back to school, and every morning we could go through the shrubbery to the big pond where the early mist lay thick and watch the wild ducks down on the still gray water. When the sun had dried the soaking grass we wandered about freely and boldly explored the haunted avenue in the daylight and then went on to see the farm.

Most of my knowledge of that country was taken from the point of view of the road and the hedges; for when a child is small there are so few chances of seeing above the hedge line. The land by the river, which lay behind our house, I knew well, for there was no road and we always went through the fields. I love to remember

the lie of the land there, and how the pleasant low hills rose beyond the flat, green fields on the far side of the river; the sun is always shining there, glinting on the water and on the white stones where Philip and I tried to wade across. When I was at school and Philip at home reading, he used to follow the hounds over the misty hills in the winter and was often out all day. He used to tell me how he would leave home in the early dark and walk miles to the meet, and how once he was lost and walked over great stretches of new country till he came to a shepherd's cottage, where they gave him tea and offered him a sheep-dog puppy and showed him the way home. He told me how good it was to take one's boots off and eat and then read by the fire.

As I first remember Philip he was a little brown-haired boy in a dark-colored sailor-suit, slightly built, with a great look of intelligence and an open, pleasant expression, but also an air of delicacy; and sometimes his whole face was clouded with nervousness and even his shining gray eyes looked frightened and his mouth irritable.

He was always more ready to use his brain than his hands and feet, for even quite early he was slightly clumsy and easily thrown off his balance. He was quite aware of this and it made him irritably ready to tease even his elders, for he knew it was the only weapon he could successfully use. He was timid and avoided danger if he could, but if it was there and unavoidable he behaved with courage and coolness.

He was sociable and talkative and never shy. He was fond of drawing, chiefly battle pictures, with quick and lively effect, but he never seemed to spend much time or trouble over them. When he went away to school he began to learn to play the piano, but he never was clever with his fingers, and he was more interested in the kind of brain-work which he did so well. But he became passionately fond of listening to music. When quite little he would lie under the pianoforte with me when it was played, and when a schoolboy I remember his serious face when listening to the fine organ after church.

My father was devoted to Philip, and I well remember, when some stranger was present, he would place his hands on Philip's shoulders and, looking immensely tall, would say with loving pride, "My son, Philip."

When we were still quite young and slept in the same room, we generally told each other stories, but sometimes had a game

in bed before breakfast, his eager little figure in its Jaeger night-shirt and pink face all alight with enthusiasm. I was not at all a willing learner, being simply bored with such early lessons, and I found it no more interesting than the multiplication tables which were just then worrying me.

The electricity I was content to take as a mystery and learn rather like a parrot. When he was arranging some bottles he said: "Always throw away the stuff in any unlabeled bottles."

"But if you're *sure* you know what's inside?"

"You *can't* be sure unless you have a proof like a label."

"But if—"

"O shut up," he snapped, "you must always throw it away."

I loved touching the thin-necked flasks and test-tubes and helping to make experiments. He rarely allowed me to pour out acids; we had three bottles of them, hydrochloric, sulphuric and nitric, and he gave wicked personalities to them, so that I used to stand and look at the queer, thick liquids as if they were really devils that were kept in those stoppered bottles.

Philip had many catalogs from chemical manufacturers, and we used to pore over these and make lists of what we would buy if we had five or ten shillings to spend.

About two years afterward we again stayed at the schoolhouse out of term, but now I was really part of it; also there were two girls staying there for the holidays whose parents were abroad. Before Philip came I had talked so much about him, that when he really did come I was a little nervous as to whether he would come up to the high standard of brilliance I had set for him. But all went well; the girls admired his jokes and talk and looks.

We four went up to London to the Zoo one day; this was the place Philip and I liked beyond any other in London, and the girls came because we wanted them so much. Philip enjoyed it as much as I did, but much more sensibly; he talked to the keepers, who seemed to like him as much as the engine-drivers always did.

When he left school I was still at mine, and he used to send me wonderful "magazines" written and illustrated by himself on a sheet of note-paper, telling me all the small news of our home. There were often photographs of animals "given away as a supplement to the number," for chemistry had now grown into an interest in photography.[1] He was very thorough about all the details of

[1] This interest is reflected in Mr. Jourdain's first papers, published while he was still an undergraduate, on "Colour Photography."

developing, and was much more particular about washing a plate than about washing his own hands, and tried hard to make me so.

This thoroughness in his work never left him. And though he had enthusiasms, for toys when he was little and for people when he grew bigger, which rapidly cooled, yet his enthusiasm for scientific work never did; and he made me feel, even when we were only school-children, its undying importance.

After our father died, we went to live in a little house at Cambridge so that Philip could live with us and go to college. I was still at school but saw him in the holidays, looking so fine, I thought, in his dark blue gown, and happy as long as his College library was open; I used to feel nearly bursting with pride as I helped him on with his gown and stroked its shining folds. He took me to see this library, and showed me where he worked in a huge underground room. He got me botanical books and left me; when it was time to go, I heard his rather quick, uncertain step on the stone floor as he came to my table. He gave me his arm and we went out together up the stairs, along the echoing cloisters and down the rounded stone steps from the dining-hall where there was nothing to hold on to; there was a horrid, breathless minute and then we were safe on the pavement, the Great Court stretching far round us in all its ancient quietness, so that buildings which lay along its sides looked small till we came up to them.

I left school at Easter and came home, so that now I could see him in the term time when he was much busier, often hurrying to lectures, his face looking strained with too much walking. But he looked so happy when he spoke of the jokes and tales in other men's rooms. I got to know them all by name and the different places where they "kept."

I suppose most undergraduates do not tell their mother and sister more than they can help, but Philip was so happy in the bit of life he had got, though he must have felt how incomplete it was, that he simply overflowed to us.

Sometimes he would give tea-parties himself in our dining-room, and I could hear his friends, through the bathroom window, singing the song of how the animals went into the ark and how the Englishman

> "Was marr-i-ed
> To a mer-ma-id
> At the bottom of the deep blue sea."

to the tune of "Rule Britannia."

first I believe to hold it for pure mathematical work. Enough has been said of the work of these years, 1902-1905, to show that it was a time of immense activity and fruitfulness. They were, moreover, followed by many years of equal productivity. Only an indomitable will to rise above all physical drawbacks could have enabled him, by steady work, to produce so long and so valuable a series of contributions to knowledge. In giving a true picture of the man and his work it has been necessary to speak of those drawbacks, and to refer to the partial paralysis from which he was destined to suffer throughout the rest of his life. But to all who came into personal contact with him his physical disabilities at once faded into complete insignificance in face of the obvious greatness of the man himself. His overflowing mental energy and his frank and generous spirit overshadowed everything else and combined to impress upon all who met him that they were in the presence of one of the most stimulating men of his time.

Based on his early work, and developing along the two main lines of interest which appear in it—namely, the theory of aggregates and analytical mechanics—were a large number of papers between 1906 and 1913. But the two lines of interest were not isolated from each other; they reacted reciprocally. Thus in the first article he wrote for *The Monist* ("On some Points in the Foundations of Mathematical Physics," 1908, XVIII, p. 217) Mr. Jourdain attempted the exact formulation of certain fundamental conceptions of mathematical physics, such as causality, by the application of results he had reached in the mathematical theory of aggregates. This article, moreover, shows the beginnings of that keen interest in the logical and philosophical foundations of science which characterizes all his later work. Of the technical papers on mathematical subjects which fall in this period special reference should be made to the long series of articles on "The De-

velopment of the Mathematical Theory of Transfinite Numbers" which began in the *Archiv der Math. und Physik* for 1906 and continued to 1912. This series forms a complete and scholarly history of the whole subject and is well worthy of translation and re-publication. Another noteworthy set of papers is the series in the *Quart. Journ. of Math.* on "The Development of the Theories of Mathematical Logic and the Principles of Mathematics." Of these the 1910 paper deals with the logical work of Leibniz and Boole; the 1912, with the work of MacColl, Frege and Peano; and the 1913, with Jevons. These two series of historical papers, together with the historical one ("Fourier's Influence on the Conceptions of Mathematics") of the three papers which he read at the International Congress of Mathematicians at Cambridge in 1912, exemplify Mr. Jourdain's growing concern with the history of mathematical ideas.

It is necessary to turn aside for a moment at this point in order to make it perfectly clear that this historical aspect of Mr. Jourdain's work did not involve any falling away into psychological logic. His belief in the objective nature of the world of universals studied in mathematics and logic remained unshaken. This is obvious from his humorous castigation, in his last book—*The Philosophy of Mr. B*rtr*nd R*ss*ll,* 1918—of the psychological logicians. Speaking ironically of them he says (p. 88), "I sometimes feel inclined to apply the historical method to the multiplication table. I should make a statistical inquiry among schoolchildren, before their pristine wisdom has been biased by teachers. I should put down their answers as to what 6 times 9 amounts to, I should work out the average of their answers to six places of decimals, and should then decide that, at the present stage of human development this average is the value of 6 times 9." Yet, holding as he did that "history is irrelevant to logic, that the truth or falsity of

a proposition is independent of the way in which so-and-so discovered it," he could still recognize that the world of universals in all its clear-cut immutability is only reached by a long *process* which is not wholly logical. The distinction which he made between the process by which we reach the final logical objective and that objective itself enabled him without inconsistency to sympathize with Poincaré's insistence on the synthetic and intuitional mode by which mathematical discovery advances, and yet to dispute that writer's claim that the final result is tainted by its psychological origins. In his last paper, on which he was engaged when he died, Mr. Jourdain gave an admirably clear account of the importance and true place of the historical process of discovery. "Nowadays," he wrote, "we can see clearly that the subject-matter of what we call 'logic' and 'mathematics' is a set of primitive ideas (or ideas which are incapable of further analysis) and deductive relations (which enable conclusions to be drawn without any appeal to experience) between these ideas. For the purpose of description in a way which shall economize the labor of thought as much as possible, we arrive at 'concepts,' which might be described as definitions of complex ideas and relations. Certain of these concepts were early perceived more or less vaguely. The vague images formed of the concepts by various people may be called 'ideoids.'" The distinction which Mr. Jourdain here draws is the same as that made between a "concept" and a "conception" in his paper "The Function of Symbolism in Mathematical Logic" (*Scientia,* 1917, XXI, p. 4). But it is, he suggests, less ambiguous to retain "conception" for its common usage as meaning the *formation* of what he now calls "ideoids." He continues, "The chief problem of the history of science seems to be that of describing as nearly as possible the various ideoids that have appeared from time to time." It is difficult to know when the psycho-

logical impurities—which, mixed with concepts, give the alloys called ideoids—are completely removed. And that is why the history of a science is of use even to the logician. Nevertheless, we must not forget that the impurity is different in nature from the pure stuff of concepts. "Concepts," he urges, "are not *formed* by people, but *discovered* by them." "On the other hand, ideoids are so formed; because they are just the vague notions that people form of concepts. Most people have a vague feeling of important concepts....In any historical view we should try to give greater distinctness to the vague notions which nearly everybody possesses; and this problem, which is not unlike that of the poet who seeks to give expression to the ideas held obscurely by a large number of those of his own country, is of importance at the present time, because examples of the discovery of concepts which lurk in ideoids is a constantly recurring problem of science." The history of science may therefore be of use even to the logician and original worker; and is certainly of value to the teacher. It is as great a mistake, wrote Mr. Jourdain in *Mind* (1916, 25, p. 526), to "banish from teaching a discussion of the growth of ideas as it is to try to build a house without scaffolding on the ground that the scaffolding is not part of the building."

We must now return to the middle section of Mr. Jourdain's work, stretching roughly from 1906 to 1913, with which we were dealing. It was toward the end of this period, in 1912, that the late Dr. Paul Carus, while on a visit to the Congress mentioned above at Cambridge, met Mr. Jourdain and invited him to become the English Editor of *The Monist*. By this happy choice Dr. Carus was able to open up an extended sphere of influence for this Journal, and for the philosophical and scientific publications of the Open Court Publishing Company. A list of Mr. Jourdain's *Monist* articles is appended to this notice. It will be noted

that it was in this Journal that Mr. Jourdain published the series of papers on Newton which has made him the recognized authority in this field. Besides the editing of several volumes—including De Morgan's *Essays on the Life and Work of Newton*, Mach's *History and Root of the Principle of the Conservation of Energy*, Cantor's *Contributions to the Founding of the Theory of Transfinite Numbers*, and Boole's *Laws of Thought*—Mr. Jourdain also initiated the new series of Classics of Science and Philosophy. His translation of Mach's great work on *The Principles of the Theory of Heat* was completed just before his death. These labors stretched therefore over the remaining period of Mr. Jourdain's life from 1912 onward. But they by no means complete the tale of his work. He wrote, for example, a large number of encyclopedia articles, both of a technical and a popular nature. His little book on *The Nature of Mathematics* (first published 1912; new edition 1919) is a well-known and much appreciated example of his power to make abstruse subjects clear. He contributed articles on the historical and philosophical foundations of science to an exceptionally wide range of learned journals: to *Mind*, to *Scientia*, to *Isis*, to Dr. Singer's *Studies in the History and Method of Science*, to the Hastings' *Encyclopedia of Religion and Ethics*, and to the *Hibbert Journal*. In addition he felt it his duty to spare an immense amount of time from his own work to the thankless task of abstracting mathematical literature. This labor he gave cheerfully because he felt it to be an essential to mathematical progress; he therefore contributed abstracts to the *Jahrbuch* and to the *Revue Semestrielle*. In January, 1916, he began the series of well-known summaries of "Recent Advances in Mathematics" to *Science Progress* which was so valuable a feature of that journal. All who have made use of this part of Mr. Jourdain's work owe him a debt of gratitude. His encyclopedic knowledge of mathematical

literature, and his sense of the interconnectedness of the whole field, ensured its scholarly accuracy and completeness. Mr. Jourdain also contributed abstracts of current literature, to *Mind*, *The Monist* and *Isis*. He had also, at the time of his death, been for some years English Editor of the *International Journal of Ethics*.

It would, however, be a complete misconception of Mr. Jourdain's character if it were imagined from this record of his vigorous intellectual activity that he was merely a learned pedant wholly immersed in the things of the mind. He was, as well, a many-sided and lovable man, full of human kindliness and never-failing good humor. His intellectual interests, it is true, often directed his wit—which though caustic was always genial, and as refreshing as a cold bath—into logical channels. *The Philosophy of Mr. B*rtr*nd R*ss*ll* is full of clever and amusing illustrations of logical problems; and the article in *Mind*, "The Flying Arrow: An Anachronism," is an admirable example of his instructive fun. But in addition to these playful portions of his more serious labors Mr. Jourdain produced a great amount of the "literary work" which he stated to be his form of "recreation" in *Who's Who*. The boyish power of pointed and satirical versification which Miss Jourdain describes, found a natural outlet, when he went to Cambridge, in the ever exuberant field of university journalism. The contributions, both poetic and otherwise, of "P. J." to *The Granta* became at one time quite a feature of that journal. Perhaps his most successful series was that entitled "Some Unconscious Humorists of the Nineteenth Century." These included, among others, William Wordsworth, Mrs. Humphrey Ward, Thomas Carlyle, Sir Oliver Lodge and Miss Marie Corelli. These articles are not only extremely good fun, but also contain sufficient solid criticism to justify the hard knocks he so joyously delivers. Thus he quotes Carlyle's dictum "Not our Logical, Men-

Enough has been said of this side of Mr. Jourdain's activities to make it clear that, besides carving out for himself a world-wide reputation as a scholar, his wit and geniality made him quite a figure in Cambridge life both during his student days and after his return thither in 1911. To his cottage in Girton village came not only eminent mathematicians of all countries but also the contemporary undergraduate. It was here that Mr. Jourdain met Miss Laura Insull, the youngest daughter of the Rev. Walter Insull, whom he married in 1915. In this year Mr. Jourdain finally left Cambridge and spent his very happy married life at Fleet in Hampshire.

Though he was unable to travel, Mr. Jourdain made his influence felt in every part of the world. His extensive correspondence with learned men bears witness to this. Moreover, his work has had well-marked effects in several fields of thought. Not only by his own original contributions, but also by his power of clear exposition of the work of others, he has influenced the development of mathematical logic. Again, a large part of the movement toward a more orderly and systematic organization of the contributions of all nations to the advancement of science is due to his forcible advocacy. Another movement in which his influence is clearly traceable is that toward an alliance between historians and scientists. It has long enough been realized that political history has overshadowed all other aspects of man. The task of creating a general history of civilization and of its basis in scientific advance has not yet, however, received its due share of attention. So long as existing histories of science were mere matters of trivial biographical detail, the value of this new line of work was little recognized. But Mr. Jourdain helped to show that a true history of *scientific conceptions themselves*—and not of particular accidents concerning them—was possible, and desirable from the point of view of both history and science.

He was thus able to exert a definite influence upon the growing movement toward such a history.

It remains to be said that Mr. Jourdain's death came at a moment when he was at the height of his power. He had just claimed to have discovered a proof, which if valid is of the very first importance in mathematical logic, that any aggregate can be well-ordered; he was publishing in *Mind* important papers on "Causality, Induction and Probability," of which only the first is completed; he was engaged on a monumental work on *The History of Mathematical Thought*; and he was working at the great project of the issue of a National Edition of Newton. His untimely death carries with it, therefore, a sense of loss which is more than a personal one. Yet there is something of comfort, to all his friends, to know that this brave soul died—as he would have wished to die—in the full tide of his life-work.

Mr. Jourdain's Articles in "The Monist" (1908-1920).

1908:	XVIII, p. 217.	On Some Points in the Foundation of Mathematical Physics.
1910:	XX, p. 93.	Transfinite Numbers and the Principles of Mathematics.
	XX, p. 134.	A Mathematical Paradox.
1911:	XXI, p. 564.	Some Modern Advances in Logic.
1912:	XXII, p. 149.	Mr. Bertrand Russell's First Work on the Principles of Mathematics.
	XXII, p. 285.	The Principle of Least Action.
	XXII, p. 414.	Maupertuis and the Principle of Least Action.
	XXII, p. 611.	Henri Poincaré.
1913:	XXIII, p. 145.	A Correction and Some Remarks.
	XXIII, p. 277.	The Nature and Validity of the Principle of Least Action.

	XXIII, p. 353.	Robert Hooke as a Precursor of Newton.
1914:	XXIV, p. 134.	The Economy of Thought.
	XXIV, p. 188.	The Principles of Mechanics with Newton (1666-1679).
	XXIV, p. 515.	The Principles of Mechanics with Newton (1679-1687).
1915:	XXV, p. 79.	Newton's Hypotheses of Ether and Gravitation from 1672 to 1679.
	XXV, p. 140.	The Purely Ordinal Conceptions of Mathematics and Their Significance for Mathematical Physics.
	XXV, p. 234.	Newton's Hypotheses of Ether and Gravitation from 1679 to 1693.
	XXV, p. 418.	Newton's Hypotheses of Ether and Gravitation from 1693 to 1726.
	XXV, p. 633.	Mathematicians and Philosophers.
1916:	XXVI, p. 24.	The Philosophy of Mr. B*rtr*nd R*ss*ll.
	XXVI, p. 415.	Richard Dedekind.
	XXVI, p. 504.	The Logical Work of Leibniz.
1917:	XXVII, p. 142.	Existents and Entities.
	XXVII, p. 460.	Logic and Psychology.
1918:	XXVIII, p. 629.	Galileo and Newton.
1919:	XXIX, p. 450.	The Logical Significance of Ockham's Razor.
	XXIX, p. 453.	Cause and Effect.
	XXIX, p. 547.	Indefinables and Indemonstrables in Mathematics and Theology.
1920:	XXX, p. 19.	The Analytical Treatment of Newton's Problem.
	XXX, p. 183.	Elliptic Orbits and the Growth of the Third Law with Newton.
	XXX, p. 199.	Newton's Theorems on the Attraction of Spheres.

ELLIPTIC ORBITS AND THE GROWTH OF THE THIRD LAW WITH NEWTON.

IN my first article on Newton in this magazine[1] is quoted a memorandum written by Newton saying that in 1666 he began to think of the possibility of gravity reaching the moon's orbit. First of all he found the force along the normal to a circular orbit in a sphere due to a particle revolving within this sphere in the orbit mentioned. Having thus found what is generally known as "Huygens's theorem," $f = v^2/r$, he deduced "from Kepler's rule of the periodical times of the planets being in a sesquialterate proportion of their distances from the centers of their orbits" (that is to say, that the cubes of the latter distances are proportional to the squares of the periodic times), that the forces which keep the planets in their orbits must be inversely as the squares of their distances from the centers about which they revolve. The comparison of the distance fallen through by the moon in a short time with the distance it would fall through under a force inversely proportional to the square of its distance from the earth's surface was found to answer "pretty nearly." The same law of force would result from considering, as Newton did in 1675, the gravitating force as an emanation from the attracting body; for the areas of the surface of the spheres to be affected at greater and greater distances increase as the squares of their radii, since the area of the surface of a

[1] *The Monist*, Vol. XXIV, 1914, p. 198.

sphere of radius r is $4\pi r^2$, and hence the intensity of the force at any particular point on any sphere to be affected would be inversely as the square of the radius of the sphere. Further, at a later period which we have some grounds for fixing as the end of 1679 or the beginning of 1680, though it might possibly have been about two years or more before this, Newton found that under a central force varying inversely as the square of the distance from the center, a small body must revolve in an ellipse with the center of force as a focus, and with a radius drawn to that center describe areas proportional to the times. It should be noticed that the law of areas was not found in 1666, and does not seem to have been at first found for central forces in general. In this article my first purpose is to attempt a reconstruction of the Newtonian process of advancing from the not very difficult investigation of circular orbits to that of more general orbits. This seems to have occupied his thoughts in 1679 and 1680, and he had not advanced beyond this point before Halley's visit in 1684.

The following is a summary of the contents of this article. Section I: The essential point in the calculation of the central force from the orbit or (by simply reversing the calculation) the orbit from the force is the finding of the distance fallen through by the attracted body toward the center of force in any infinitesimal time. From this expression the time could obviously be eliminated by Kepler's law of areas, and this law and its generalization for *any* central force were fairly obvious deductively. A somewhat simpler proof of the generalized theorem seems to have been devised, and the theorem placed in its proper logical position as first of the series on central forces. The tract which Newton wrote in 1684 and the various editions of the *Principia* (1687, 1713, 1726) have been carefully compared; and the comparison has brought to light the remarkable fact, which does not seem to have been noticed hitherto,

that many changes were introduced into the edition of 1713 which give the expression of the central force in "intrinsic" coordinates. This expression had been given by Johann Bernoulli in 1710, and it is thus incorrect to attribute it to Newton (Sections II and IV). Section III is concerned with Newton's indirect method of finding the orbit from the force and with the mistaken assertion of Bernoulli and others that Newton's proof contains an error. Section V contains a contribution to the problem as to the way in which Newton arrived at his third Law.

I.

In the article referred to, we have seen that the essential thing to be determined in the case of a circular orbit was seen by Newton to be the distance fallen through in an infinitely small period of time. The same determination, as we shall shortly see, is also the essential thing in the strict calculation of orbits other than circular, and the determination in such a case is much more difficult since it requires a knowledge of technical mathematics that such men as Wren, Hooke, and Halley do not seem to have possessed.

Let us consider a small body made to revolve round a fixed center of force (S) attracting as the square of the distance from it, by being projected from a certain point with a certain velocity in a direction which is not along the line toward S. To form some idea of what the orbit is like, we will divide the whole time considered into a very large number of equal parts and work out, as any mathematician of the seventeenth century after Galileo naturally would, what would happen if the force toward S were to adjust itself by jerks at the end of each subdivision of time and were constant throughout each of these subdivisions. Suppose that the length of each of these subdivisions of time is so short that f, the numerical measure of the accel-

eration toward S due to the force, may be considered as constant between the positions of the body at the beginning and end of any subdivision of the time. Then, by Galileo's law, the distance fallen through toward S is $ft^2/2$, t being the length of a subdivision. Thus, as Newton showed in the sixth Proposition of the first Book of the *Principia*,[2] f is proportional to q/t^2, where q is the half versed sine which expresses the distance fallen through in the time t. Newton, at least in his later work, considered the versed sine in the middle of an evanescent arc and noticed that it points toward the center of force. Of course at that time trigonometrical functions were *lines* and not the *ratios* they became later on.

Newton's next problem was to express this infinitesimal time in terms of quantities belonging to the curve described, so that the orbit could be found from a knowledge of f, and f could be found from a knowledge of the orbit. The way to this expression would be shown by Kepler's discovery that the areas swept out by the radius vector joining a planet to the sun are proportional to the times of describing them, and thus that our t is proportional to a small triangular area whose calculation is discussed below. We will now consider whether Kepler's proposition can be deduced from general suppositions as to the motion of the small body about S.

Suppose that the body is projected at P in the direction PR under the influence of an attractive force to the fixed center S; then PR will be the tangent at the point of the orbit. If Q is a point on the orbit infinitely near P, and reached at an infinitesimal time, which we may denote by dt, after it leaves P, and QR is parallel to SP, then RQ is half the versed sine of the infinitely small arc PQV, where

[2] Any edition of the *Principia* will do. This reference is only made for shortness, as the method used by Newton to establish this result could not surely vary greatly from 1679 to 1713. It is on another question that the variations in Prop. VI throw light, as will be shown below.

V is a point on the orbit and QV is equal to PQ. Then RQ is equal to the diagonal of the parallelogram of adjacent sides PQ and QV, and this diagonal when produced passes through S. The diagonal mentioned is also proportional to the central force at Q. Since, now, RQ is parallel to PS, it is evident that the triangle SPQ, which is the area swept out by the radius vector in an infinitely small part of time, is equal in area to the triangle SPR. Proceeding in this way, if we imagine the original particle to proceed along the line PR unaffected by the force at S and therefore with unaltered velocity, so that equal spaces PR, RW, and so on, are described in equal times, the corresponding triangles formed by the actual orbit, SPQ, SQV, and so on, are all equal to one another and to the triangle SPR. Adding up all the infinitesimal triangles formed by the orbit, SP, and some other radius vector, and then going to the limit in the way familiar to those who worked with infinitesimals, we can conclude that the areas described by the radius vector increase proportionally to the time.

This is seen to be independent of the magnitude of the force directed to S, and indeed, from a logical point of view, it is the first proposition to be proved about central forces. Accordingly, though considerations on the centripetal force causing motion in a circle probably preceded the discovery of the theorem on the equable description of areas, we find the theorem as the first in the formally written out *Propositiones de Motu* of 1684[3] and as the first Proposition of the first Book of the *Principia* (Section II).[4] In both these places, however, the continuously acting central force is not a force acting constantly throughout each small interval of time, but is replaced by impulsive

[3] Rouse Ball, *Essay*, pp. 36-37.

[4] The two Corollaries printed in the first edition were omitted in the second edition, and a new set of six Corollaries added, of which the first, which is that v varies inversely as p, will be mentioned subsequently.

forces acting toward S at the end of each small interval. The latter method is rather simpler since we do not have to consider that the space through which the central force draws the particle in an infinitely small time is proportional to the square of the time. When the number of the infinitesimal triangles is increased indefinitely, this perimeter ultimately becomes a continuous curve and the instantaneous forces ultimately become a continuously acting force by which the body is continuously deflected from the tangents. Also in the latter case, the half versed sines mentioned above appear at once as diagonals to the parallelograms determined by consecutive arcs of the orbit. The second and third Propositions form the easily proved converse of the first.[5]

If now we substitute in our equation for f the value of t, or dt as it was called later, in the terms of the elementary area described in the instant dt, which is expressed by the area SPQ, which is half the product of SP, or r, and the perpendicular from Q on SP, which we may call QT, we find that f is proportional to l/r^2, where l is the limiting value of QR/QT^2 when PQ is infinitely small. This quantity l is found to depend merely on the curvature of the curve, and it can be found in any particular case. The formula expressing f as varying inversely as r^2 was given as the third Proposition of the *Propositiones de Motu* of 1684[6] and also in the sixth Proposition of the first Book of the *Principia*. The second and third Corollaries to this Proposition, which first appeared in the second edition, relate to another method of finding the area of the elementary triangle SPQ which does not involve r explicitly, but

[5] There is nothing to correspond to the second and third Propositions in Newton's tract of 1684. In the second edition of the *Principia* no very important alterations were made to these propositions, but two Corollaries were added to the second.

[6] Rouse Ball, *op. cit.*, pp. 37-38.

the area of the triangle is expressed in terms of the perpendicular p from S on PR and the arc PQ or ds.

II.

There are three things to be noticed about this second determination of the orbit. The first is that it was not given in the above-mentioned tract of 1684. The second is that in the first edition of the *Principia*, the sixth Proposition was that f is proportional to l/r^2 ("is ultimately reciprocally as the solid SP quad. $\times$ QT quad./QR"), and the Corollary simply stated that, if the orbit is given, the law of force will be found from l/r^2 in various cases in the following Propositions. In the second edition of 1713[7] the sixth Proposition was that f varies as q/t^2, and it had five Corollaries: the first gave the fact that f is proportional to l/r^2; the second, third, and fourth that f is proportional to $QR/(p.ds)^2$, and special cases; and the fifth is much as the Corollary in the first edition. The third thing is that the fact that v varies inversely as p was not explicitly noticed in the first edition of the *Principia*, but the first Corollary to the first Proposition in the second edition contains this remark. This third point is only of importance in the light of the first and second. For these reasons it seems, then, that Newton did not at first make use of the equation of the orbit which is given in terms of p and r, but only of the equation expressing that f varies directly as l and inversely as r^2. This form of the equation also seems very suggestive of the force varying inversely as r^2, and we only have to determine l and show that it does not depend on r.

In the tract of 1684, Newton determined this quantity

[7] It is not impossible that the second, third, and fourth Corollaries were added in consequence of Bernoulli's paper of 1710, in which the advantages of working with a (p, r) equation were first shown. Lord Brougham and E. J. Routh (*Analytical View of Sir Isaac Newton's Principia*, London, 1855, pp. 45-48, 52) unjustly speak as if Newton explicitly gave this formula before Bernoulli. On the importance of such equations cf. *ibid.*, pp. 63-64.

for various curves in almost exactly the same way as he determined it in the *Principia*. In the first problem of the tract Newton solves the question of finding the law of force tending to any point in the circumference of a circle when a body revolves in the circumference.[8] This is the same as the seventh Proposition of the first Book of the first edition of the *Principia*: in the second edition this Proposition was the more general one to find the law of force to *any* given point when the body revolves in the circumference of a circle. The second problem of the tract was to find, if the body revolves in an ellipse, the law of force tending to the center of the ellipse.[9] This is the same as the tenth Proposition of the first Book of the *Principia*.[10] The third problem of the tract is: If a body revolves in an ellipse, to find the law of centripetal force tending to the focus.[11] This important Proposition is the eleventh of the first Book of the *Principia*.[12]

In this Proposition we find that the limit l referred to above is, from geometrical considerations, h^2a/b^2. When the center of force is to be at the center of the ellipse, we find that $2l$ is r^3/a^2b^2, and is therefore not independent of r. We see, then, that the centripetal force to the center of the ellipse is proportional to r.

III.

Kepler's first law is that the planets move in ellipses having the sun in one focus; so that Newton's Proposition shows that the force exerted upon them by the sun must be inversely proportional to the square of the distance. The

[8] Rouse Ball, *op. cit.*, pp. 38-39.

[9] *Ibid.*, pp. 39-40.

[10] This proof is repeated in the second edition, but in the second edition an alternative proof, which makes use of the third Corollary of Proposition VI, is also given.

[11] Rouse Ball, *op. cit.*, pp. 40-41.

[12] An alternative proof was added in the second edition.

converse of this proposition can be quite easily proved by returning backward in the argument, and this would appear to have been the way in which Newton assured himself that a body under the action of a centripetal force varying inversely as the square of the distance moves in one of the conic sections. This was stated as the first Corollary to the thirteenth Proposition of the *Principia*,[13] the twelfth and thirteenth Propositions having proved that the force tending to the focus when the body moves in a hyperbola or parabola is inversely as the square of the distance.[14]

In both the second and third problems of the tract of 1684, an essential point in the geometrical argument is a use made of the diameter of the ellipse through the center C which is conjugate to the diameter CP. To this fact apparently refers the incident described by Conduitt after Halley left Cambridge in 1684, when Newton, trying to reproduce his calculation of the path described by a body under a force varying inversely as the square of the distance, failed to obtain his former result because "in describing an ellipse coarsely with his own hand, he had drawn the two axes of the curve instead of two conjugate diameters somewhat inclined to one another. When this mistake was corrected he obtained the result which he had announced to Halley."[15] This passage was noticed particularly by De Morgan, who said that it "carries truth on the face of it."[16]

When Newton had found that a body acted upon by a centripetal force directed to a fixed point and measured by μ/r^2 describes an ellipse about that fixed point as a focus,

[13] This Proposition was practically unaltered in the second edition.

[14] The only important change made in the twelfth Proposition in the second edition of the *Principia* was the addition of an alternative proof.

[15] Rouse Ball, *op. cit.*, p. 26.

[16] *Essays on the Life and Work of Newton*, Chicago and London, 1914, p. 141.

of such a kind that μ is proportional to a/b^2, he would find that the periodic time T is given by $2\pi ab/h$, where for h is substituted the square root of $\mu b^2/a$; πab being the known expression for the area of an ellipse. From this equation we easily find that T is proportional to $a^{3/2}$ or that T^2 is proportional to a^3. This expresses Kepler's third law that the squares of the periodic times are proportional to the cubes of the major axes; and, in the fourth theorem of the tract of 1684, Newton proved this law of Kepler and added a note on the application to planetary motion. This theorem is the same as the fifteenth Proposition of the first Book of the *Principia*,[17] "that the periodic times in ellipses are in the sesquiduplicate ratio of their major axes," but to this Proposition no addition about planetary motion was made.

The fourth problem[18] of the tract of 1684 is: "Given that the centripetal force is inversely proportional to the square of the distance from the center of force, and knowing the quantity of that force, it is required to determine the ellipse which a body, projected from a given point with a given velocity, describes." This problem should be compared with the seventeenth Proposition of the first Book of the *Principia*:[19] "Supposing the centripetal force to be reciprocally proportional to the squares of the distance from the center, and that the absolute quantity of that force is known; it is required to determine the line which

[17] Unaltered in all editions.

[18] Rouse Ball, *op. cit.*, pp. 43-44.

[19] In the second edition, some words of explanation were added at the end of the demonstration, possibly in view of the criticism by Johann Bernoulli in 1710. This criticism certainly directed attention to an obscurity of Newton: the obscurity did not happen to hide an error, in view of Prop. XIII, Cor. I (to which also a fuller explanation was added in the second edition). Still, Brougham and Routh (*op. cit.*, pp. 58, 62) treat Bernoulli's contention with rather unnecessary harshness. It may be added that, except for the addition just mentioned and a scholium on motion in a conic under a force to any point, that was added to the second edition, Prop. XVII remained unchanged in all editions of the *Principia*.

a body will describe that is let go from a given place with a given velocity in the direction of a given right line." In 1684 the motion of the body P was compared with the *circular* orbit of another body revolving under the same force: in 1687 the body P was compared with a body p revolving in *any given* orbit. In 1684 P was assumed to describe an ellipse: in 1687 it was assumed to describe any conic section. Indeed, in the tract of 1684, the possibility of P describing a parabola or a hyperbola was only referred to at the end of this fourth problem, whereas parabolic and hyperbolic motion were proved to arise from a force varying inversely as the square of the distance in the thirteenth and twelfth Propositions respectively of the *Principia*, and, as has been mentioned, the first Corollary of the thirteenth Proposition indicates that conversely P moves in one of the conic sections about a focus from which proceeds a force of the kind mentioned. Lastly, in the tract of 1684, there was added to this fourth problem a note on cometary paths "which," according to Rouse Ball,[20] "is obscure and partly incorrect."

The rest of the tract of 1684 is devoted to a determination of the space through which a body will fall in a given time toward a center of attraction varying inversely as the square of the distance, and some determinations of the motions of projectiles in resisting mediums.

We may mention here that, among Newton's manuscripts in the Portsmouth Collection at Cambridge, there is[21] a fragment in which fluxions are employed in finding the centripetal force in an orbit. This seems to afford additional evidence that the method of fluxions was used in the discovery of the theorems afterward proved in a more Euclidean manner in the *Principia*.

[20] *Op. cit.*, p. 34.

[21] *Portsmouth Catalogue*, p. 4.

IV.

In my first article on Newton in this magazine, there is[22] an investigation of the law of force for an orbit which is not circular. It does not now seem to me very probable that the first great mathematical advance of Newton lay in satisfying himself by infinitesimal considerations that he could pass from the simple case of circular orbits to the general case. It must always be remembered that we have very little documentary evidence as to Newton's process of discovery, and that thus a reconstruction of this process can very often claim only a greater or less degree of probability. While, then, it does not seem to me likely that Newton would have been content with assuring himself in the above way that the law of the inverse square held for non-circular orbits, it seems to have been the case—as was indeed natural—that the infinitesimal elements of an orbit were considered on occasion as circular. Thus Newton worked with the versed sine of any arc.

In an infinitesimal interval, the body in all the cases which, if we are not bent on devising cases in which the curvature of the orbit becomes infinite or irregular, usually occur to us describes a circular arc about the center of curvature at the point of the curve which we consider, and Newton may possibly thus have assured himself, at least until he had strictly calculated the shape of orbits described under a given force, that the same law of force which holds for circular orbits also holds for the other orbits that occur in nature. Such an investigation may have taken place even as early as 1666, since we know that Newton was occupied in the early days of his discovery of the method of fluxions with determining the "radius of curvity" at any point of a curve.

But if Newton had found the expression v^2/ϱ for this

[22] *The Monist*, Vol. XXIV, 1914, pp. 211-213.

normal force, then, since we have at once the additional expression fp/r for this force, he would have arrived at the equation

$$f = rv^2/p\varrho.$$

Possibly also Newton found that f is proportional to q/dt^2 and that q varies as ds^2 from this last equation, as stated in Lemma XI of Section I of the first Book.

Now, by the law of the equable description of areas, $p.ds$ is proportional to dt, or, as it is usually written nowadays, $pv = h$. Substituting for v in the above equation f. we get

$$f = h^2r/p^3\varrho,$$

which is practically what Newton stated in the second and third Corollaries of his sixth Proposition in the second edition of the *Principia* (1713). This formula was first given by Johann Bernoulli in 1710; and since, as Newton announced, ds^2/q is the measure of that chord of the circle of curvature at P which is drawn from P along the line PS, we see that f is inversely proportional to this chord multiplied by p^2. We can find this chord (c) by observing that $c/2p = dr/dp$; but Newton did not indicate this formula.[23] This formula allows us to conclude that the radius of curvature is $r.dr/dp$,[24] and hence to give the simple analytical expression to the third Corollary of Newton, or the expression of Bernoulli:

$$f = h^2dp/p^3dr.$$

The first Corollary to the first Proposition of the first Book was, as I have mentioned above, added only in the second edition (1713) of the *Principia*; it is that the velocity of a body attracted toward a fixed center varies inversely as p. That this simple deduction from the law of areas was not mentioned in the first edition is perhaps an addi-

[23] Brougham and Routh (*op. cit.*, pp. 45, 46) seemed, however to state this.

[24] This expression seems to have been given first by Maclaurin in his *Treatise of Fluxions*: Maclaurin of course used the fluxional notation.

tional indication that Newton did not at first work with p and r as coordinates. If he had done so, he would, from the expression v^2/ϱ for the normal force, at once have found that f varies directly as r and inversely as $p^3\varrho$, as Bernoulli found in 1710.

In the ellipse, we can find by the analytic geometry of conic sections that ϱ is k^2/p or k^3/ab, where k is half the diameter through the center C that is conjugate to CP, and a and b are the semi-major axis and semi-minor axis. Since we also have $p = br/k$, we have, by substitution in the above expression for f, the result

$$f = h^2a/b^2r^2.$$

This section has been devoted to a formula for f for which the credit of priority seems undoubtedly to belong to Johann Bernoulli. In the same memoir Bernoulli gave a direct proof that a force inversely as the square of the distance brings about a motion satisfying Kepler's laws. However, Newton had already proved this[25] though it must be admitted that Newton's proof was neither direct nor wholly free from obscurities.

Such equations as $f = v^2/\varrho$, which seem to have been first given explicitly by Euler in 1736,[26] are in what are called "intrinsic" or "natural" coordinates. I will discuss them on another occasion.

V.

We have seen that in the Royal Society tract of 1684 the motion of a body on a fixed center of force was considered. But this case of an immovable center does not occur in nature, for we cannot be certain that the center of attraction in nature is immovable. In the case of the

[25] This fact seems to have been overlooked by Paul Stäckel in his article of 1908 on "Elementare Dynamik der Punktsysteme und starren Körper" (*Encykl. der math. Wiss.*, Vol. IV, Part 1, p. 494).

[26] *Ibid.*, p. 463.

sun, the center appears, according to Copernicus, to be stationary; but, in the case of the moon revolving round the earth, the center of attraction is not stationary but revolves in an elliptical orbit round the sun. It would seem a matter of instinctive knowledge that when we have to do with a body revolving round a very much larger one, the larger body is almost at rest. It is not a very far step to the supposition that only the center of gravity of bodies is at rest. But in the case of the solar system, we cannot say where this center of gravity is. However, it seems quite beyond doubt that Newton, from his early days, took the very natural view that what was decisive in the measure of gravity was the size and density of, or "quantity of matter in," a body. This quantity of matter would of course be a property of the body itself, and would remain the same whether or not any force of gravitation acted on it.

In a manuscript draft of 1684 which is in the Library of the University of Cambridge, England, which has been described by Rouse Ball,[27] and which I have examined, there is an additional law, expressing the consequence of the third law of motion of the *Principia*, which is of particular value in dealing with the motions of two or more mutually attracting bodies. It is that the common center of gravity of bodies does not change its state of motion or rest by the mutual actions of these bodies. This law, in the case of two bodies, is identical with the third law of motion, but in the case of three or more bodies the third law cannot be deduced from it, though it can be from the third law. In fact, if m and m' are two masses which are supposed to be alone in space, then the principle of the conservation of the motion of the center of gravity gives three equations (one for each rectangular axis) of the form

$$m(d^2x/dt^2) + m'(d^2x'/dt^2) = 0,$$

[27] *Op. cit.*, pp. 51-56.

and thus says that the accelerations are in the inverse ratio of the masses. But if there are three mass-points, we get three equations of the type of the above one, but the left-hand member of each is formed by adding three terms instead of two. Logically, we cannot deduce the mass-ratios m/m' and m'/m'' from these equations, for $a+b=0$ does not imply that a and b are each zero; although in the present case it would seem to be a very natural thing to say that m/m' would remain the same if m'' were annihilated.

The motions of two mutually attracting bodies were dealt with in the fifty-seventh to the sixty-third Propositions of the first Book (Section XI) of the *Principia*.[28] The first of these Propositions is that two attracting bodies describe similar figures about their center of gravity and about each other. The next Proposition is that if two attracting bodies revolve about their center of gravity, then under the same forces a similar and equal orbit might be described about either one of the bodies if it were fixed. The Corollaries to this Proposition show that the results of the first, tenth, eleventh, twelfth, and thirteenth Propositions of the first Book are applicable to such motions. The sixty-first Proposition is that two bodies acted upon by their mutual attractions and not otherwise agitated or obstructed, will move as if neither attracts the other but both are attracted according to the same law of force by a third body placed in their common center of gravity.

PHILIP E. B. JOURDAIN.

[28] These Propositions are practically unchanged in all three editions of the *Principia*.

NEWTON'S THEOREMS ON THE ATTRACTION OF SPHERES.

IT seems quite certain that Newton was stopped at first from pursuing the problem of the planetary motions because he very soon arrived at the idea of universal gravitation, and then thought that the calculation of the whole resultant attraction of a large piece of matter, such as the earth or the sun, is such a complicated problem that it could not at that time be solved with any approach to accuracy. Thus the description of the celestial motions which was founded on the consideration of sun and planets as points apparently could only be regarded as a very rough approximation. In 1685, however, Newton found that the problem of the attraction of a sphere on an external point admits of an unexpectedly simple solution, and it was then, under the influence of the vivid interest that would naturally be caused by the discovery that the nearly spherical planets could be treated, with a very close approximation, as mathematical points, that he returned with renewed enthusiasm to his task. We may, it seems, also conclude that the problem solved in the seventy-first Proposition of Section XII of the first Book of the *Principia*, in which the attraction of a thin spherical shell on a particle outside it was found, preceded the discovery of the seventeenth Proposition, in which the attraction of a thin spherical shell on a particle *inside* it was found. To the well-known letter to Halley of June 20, 1686, which fixes the date of the

former discovery as 1685, we may add Newton's words in the eighth Proposition of the third Book of the *Principia*:

"After I had found that the force of gravity toward a whole planet did arise from, and was compounded of, the forces of gravity toward all its parts, and toward each part was in the inverse proportion of the squares of the distances from the part; I was yet in doubt whether that inverse duplicate proportion accurately held, or only nearly so, in the total force compounded of so many partial ones. For it might be that the proportion which accurately enough held for greater distances should be wide of the truth near the surface of the planet, where the distances of the particles are unequal and their situation dissimilar. But by the help of the seventy-fifth and the seventy-sixth Propositions of the first Book and their Corollaries, I was at last satisfied of the truth of this proposition."

The methods that Newton gave in his *Principia* for finding the attractions of spherical shells and bodies are the same in all editions. He found the attraction of a thin spherical shell of uniform density on an external point, which was the first step to determining the attraction of a solid sphere on such a point, in his seventy-first Proposition. In all that follows, S will denote the center of the shell which is of radius r, and P will denote the external point. Newton first found the attraction on P of a thin zone on the shell which is the surface cut out by an infinitely small arc of a great circle in the plane of the drawing we would naturally make, when this great circle revolves round SP as diameter and therefore perpendicularly to the plane of the drawing. Each element of the surface of this zone exerts an attraction on P which is proportional directly to the area of the element and inversely to the square of its distance from P. The first step is, then, to find the area of such a zone, which is the first step in the process, usual since the time of Archimedes, for finding the

area of the surface of a sphere. By the use of mathematical artifices which are not of a very complicated character, Newton found that the component of the attraction of the zone along SP—the total attraction of the zone on P being, by symmetry, along SP—is inversely proportional to the square of SP. The same is true of any other zone whose plane is parallel to that of the zone just considered. Therefore, by composition of ratios, the whole attraction of the spherical surface is in the same duplicate ratio.

From this we can proceed to the case of a solid sphere, by summing together various homogeneous spherical shells of center S, and we thus find that the mass of the whole set of shells is as the cube of the sphere's diameter, and the attraction on P is directly as this mass and inversely as the square of SP. This is the result of the seventy-fourth Proposition together with part of the seventy-second Proposition.

In the *Principia*, the seventieth Proposition concerns the attraction exerted by a spherical shell on a particle P within it. If we imagine an infinitely small double cone drawn so that P is the vertex and the two ends of the cone cut the sphere in small circles, the attractions of these small circles on P are opposite and proportional to the squares of their diameters while they are inversely proportional to the squares of their distances from P. Imagination of the geometrical figure made by P and any section of the shell passing through Q and the axis of the cone, and use of the thirty-fifth Proposition of Euclid's third Book show that these attractions on P are equal and opposite, and that they therefore destroy one another.

An application of the seventieth and seventy-second Propositions is contained in the seventy-third Proposition, in which is determined the attraction on a particle which is situated inside a solid sphere. If another concentric sphere is imagined which passes through the particle in question,

seems sufficiently definite—only with an adverse verdict; for the opinion is widely held that owing to the final "degradation" of universal energy into the form of heat, all change and development without exception must ultimately cease.[2]

And certainly, if these impressions and conclusions are really well founded, it is difficult to regard intelligence or spirit as in any real sense determining the course of things, for its activity can be regarded only as in the end a failure, or, what is worse, a mockery. Life, mind, and culture become epiphenomena which revert to the dead matter from which they first arose. The universe, in spite of its marvel, would lack purpose and completion. For, we must note, it is the development of these highest values—of science, art, morality, religion—and their destruction that contradict true purpose and end—not any running down of the physical cycle in itself; for that, after all, might be the inevitable end of no matter how vast and wonderful a mechanism. But that the growth of reason and esthetic, the freedom of the moral agent in his choice between right and wrong, the tragic conflicts of national ideals—that these "shall dissolve....leave not a rack behind"—this, to reason itself, must ever remain repugnant and incomprehensible.

But I venture to think that in this respect philosophy, at least if it merit the name idealistic or monistic, may be less hesitant and more positive; and basing itself on the principle of the systematically unified nature of reality, may endeavor to prove that although higher values must necessarily be rare and restricted in range, nevertheless the universal change must inevitably result in the long run in the development of values which become continuously higher and higher without assignable limit: so that the

[2] For the consideration of the scientific aspects of this belief I may refer to *Science Progress*, No. 50, Oct., 1918, pp. 310-311.

ultimate retrogression which physical science regards as possible becomes philosophically wholly untenable; and alongside the scientific principle of the Conservation of Energy must be posited its philosophical counterpart—the Conservation of Value.

2. It is often objected, however, against philosophical arguments in general, that they set out from unanalyzed assumptions, which being shown to be ill founded, invalidate the supposed conclusion; and too often this defect must be admitted. But in postulating here the systematic unity of reality, the only principle employed is that which forms the basis of science itself, so far as this demands uniformity and law. For law can only be universal, if the reality whose nature it reveals or interprets be systematic, interconnected, or interrelated throughout its whole extent. Universal law in scientific thought must be based on universal connection in real existence. And while both are ideals, still they stand or fall together, so that to question our initial principle is at the same time to impugn the basis of all modern science.

For the progress of scientific knowledge is sporadic and fitful only to a casual view. In reality, the enunciation of every new law affects the whole body of law previously ascertained, and has its due effect in determining later discoveries; and this increasingly with each new advance,[3] so that it is becoming more and more difficult to specialize very strictly: every new law of importance throws its light on wider and wider groups of phenomena, and is applicable to more numerous cases.[4]

Therefore to assert that the unity of reality is systematic—interconnected—is also on the one hand to ex-

[3] Just as, e. g., the organism is permanently affected to some degree by every stimulus; or national law by all new legislation.

[4] The influence of the discovery of radio-activity on the theory of the constitution of matter is a recent instance; cf. again the principle of natural selection.

clude an impossible homogeneity plainly incompatible with system, and on the other to admit a practical or limited pluralism, in so far as this demands substantial heterogeneity without ultimate disconnection. For though monism is a principle which can neither be finally proved nor yet wholly dispensed with, still it does not forbid the demarcation of the whole into distinct regions with which thought can deal in separate sciences; and from this point of view philosophy must always remain *scientia scientiarum.*

Another facile objection to the "philosophy of value" is akin to that so often leveled against religious ideas—that of undue anthropomorphism. "Value," it may be urged, must in the end resolve into value for our thought,[5] and therefore its standard and sanction can never be objective and ultimate; it must (the analogous arguments in ethics will be familiar) always be unstable, varying with each new age's experience and outlook; "value" is essentially a conception at once subjective and temporal, rather than objective and eternal; it is a *Zeitgeist* rather than a *Weltgeist.* But while to this point of view must be conceded its due importance, still to insist upon it as final is to overemphasize what is merely an aspect inseparable from all our experience. For in so far as the mind's activity enters into the structure of all knowledge without any distinction whatever, this defect of subjectivity (if it be a defect) invalidates all our conceptions equally, and not only those of religion, morality, and value.[6] With these all our esthetic and scientific ideas alike are nullified,[7] and thought in brief is simply asked to commit suicide; which fatality,

[5] I should like to refer to Dr. Bosanquet's treatment of this point in *The Principle of Individuality and Value,* Lect. VIII.

[6] Of course, if it is said that these are in the end identical, I should agree; only not before the end.

[7] This argument of course is familiar; but I think that their common basis should be an equal certainty rather than dubiety.

if really inevitable, had best occur at the earliest possible moment.

3. But thought is in no predicament of this kind, even though, so slow and tortuous is its advance,[8] the idea is equally natural as deceptive. On the contrary, it surely requires little insight to recognize definite positive progress in our thinking on art, ethics, and religion; in science of course indubitably so; but science is not an activity of the mind peculiarly free from defects which are supposed to vitiate all its other manifestations. Modern thought is something more than the mere successor of previous speculation—it is also its heir, enriched by its bequests and warned by its errors, and lamentably faulty as are our moral theory and social organization, still their tone and tendency are infinitely better than the polished barbarism of pagan and medieval Europe.[9] To say, therefore, that our recognition (or even construction) of value-concepts has an inherent subjective element need not prevent our also regarding them as representing valid objective characters of ultimate reality.

We must next accord some degree at least of reality to time and change, without, however, attempting to determine their ultimate status. Whatever difficulties may attend any conception of a real which changes and endures, the world we know is certainly unintelligible apart from these attributes, even if it therefore be no more than appearance. It then appears to me that with regard to reality as thus characterized it can be shown, through the analysis of its systematic nature, that

a. All high values must be rare and restricted;

[8] "And not through Eastern windows only...."

[9] In spite of the high level attained by ethical speculation among the Greeks, their actual heartlessness, e. g., in the Peloponnesian War (probably as a result of their earlier migrations) is very remarkable, and the arguments by which it was supported strikingly similar to those employed by modern German diplomats and historians.

b. They are all possible only against a basis or background of lower values;

c. But that all change, taken as a whole, must necessarily result in the production of individuals whose value becomes increasingly higher without limit;

the last being obviously the most important.

4. Some little technicality is unavoidable, and perhaps it is best to consider a little more fully what is involved in regarding reality as being systematically at once both diverse and unified.

I have referred already to the indispensability of this conception as being the sole valid basis for universal law of whatever category—scientific, economic, or moral; and also to the practicability of reconciling within its limits the apparently opposed standpoints of monism and pluralism. These, however, are general principles, regulating the idea in its more or less formal aspect; and it seems further possible to give it a more concrete and detailed form.

Scientific classification,[10] although its classes are certainly unities, must begin by isolation and abstraction, and always retains some of the characteristics of its origin. But while classes remain merely classes, or types, it is plainly impossible to build up from them any true world; to do this we must return to those individual objects themselves from which (by abstraction) our classes were first of all formed. Perhaps an illustration may make this point clearer. The greatest novelists and dramatists differ from their less able fellows, in that, while the latter present to us what are, even at their best, only various *types* of humanity, the masters themselves create *characters*—persons—as actual and individual as living people.[11] For only thus can

[10] Really *all* classification, which, however, has reached its highest development in science.

[11] Thus Ibsen constructed in its remotest branches the life-history of his characters before writing anything of the play.

the imaginative world be given the vivid actuality of the real, and peopled with the immortals of fiction and the drama; while more commonplace effort can succeed in reproducing no more (at best) than well-drawn types of humanity at large. And philosophy may claim, though certainly in no depreciatory spirit, that some degree of analogy to this exists between its own task and that of science. For taking advantage of the indispensable preliminary classificatory work of science, philosophy seeks to return to the individual object or thing; but not, however, to this in itself simply, but rather as it must now be understood and reinterpreted in the light of scientific research upon it and its fellows. For to classify is plainly to bring a thing into some degree of relation with other things, more or less similar to itself. This is *scientific* procedure; from which philosophy differs only in carrying the same process farther, and so seeking to relate the object truly to the universe—to assign to it its due place and value within the Whole. It is true that philosophy here undertakes a task which to human intelligence is impossible in full concrete detail, for every object, even the apparently most trivial, is really unique and inexhaustible.[12] But in principle nevertheless the work is feasible and indeed obligatory; so that it remains to attempt a brief outline of some of the results of this distinctively philosophic view of the world.

Every thing or object then is, when taken in its fullest nature, in the first place unique; and secondly it is always a system, more or less complex as the case may be; i. e., in no actual instance do we ever have absolute simplicity or

[12] Cf. Tennyson's "Flower in the crannied wall...."; and contrast with Wordsworth's

> "A primrose by a river's brim
> A yellow primrose was to him,
> And it was nothing more."

The class or type, however high its value for knowledge, is always in some degree abstract and artificial; and no one would maintain (I suppose) the actual existence of any class strictly as such.

homogeneity and total absence of systematic structure, for this conception again is only attained by the abstraction and isolation of thought. But the term "unique" here is capable of two very different and indeed opposed meanings, according as it does, or does not, connote a total absence of connection with all other objects, for to be truly unique, an object should stand absolutely alone and severed from all else. But this of course is never the case; so that to say that every object is for philosophic thought "unique" means that, while only itself has *all* its attributes, still it maintains close connection with, and relation to, its environment. But "environment," again, may have a meaning as wide, or as narrow, as we choose to give it. Usually its meaning is comparatively restricted, because to determine an object's relation to its *immediate* environment is amply sufficient for ordinary knowledge and scientific purposes. But any limits thus given to "environment" are plainly more or less artificial, are merely matters of convenience. As knowledge increases, so does the meaning of "environment" expand, until it becomes, for knowledge at its widest, nothing less than the universe as a whole—

> "....all in all,
> "I should know what God and man is."

The ideal of philosophy, then, is to comprehend the universe as a complex of interrelated individual systems, and each individual again as connected with, and in its nature expressive of, the rest of the Whole outside of itself.

It must follow therefore that no characteristic or attribute whatever of any object (or system) is ever really negligible and purposeless; but rather every feature therein without exception, when thoroughly understood, indicates some definite connection or relation with the universe at large—i. e., with spheres of environment more and more remote without assignable limit.

But there are at the same time differences or gradations in this aspect between these attributes when taken in any given complex; the *fundamental* distinction,[13] which lies at the root of all others, being given by the extent of the environment to which any given attribute relates and connects the system in question. The distinction, e. g., between primary and secondary qualities[14] is as familiar as it is puzzling. But as a general principle, primary attributes relate a system to the widest possible environment—its weight, e. g., to the whole of the material universe—while all past changes have combined to impress upon it its figure.[15] Secondary qualities, again, maintain connection with a more restricted and specialized environment; while this is yet more the case if the tertiary (e. g., esthetic or moral) and higher qualities are considered.[16] In short (to repeat), every attribute connects its system to a sector, wider or narrower as the case may be, of the whole possible environment.[17] It is only when this principle has been grasped that we may be said to have attained a truly philosophic apprehension of any given system, as distinguished from a scientific understanding of it, which must always select and emphasize some particular environment and relations. And while all monism or idealism demands this universal connection, rational monism requires that it be thus systematically ordered and graded; while pluralism contents itself with merely limited views, which may, however, be the best in practice for given special purposes.

[13] Not, however, the only distinction, for there are always others more obvious and practical, which depend upon and are abstractions from the underlying distinction here indicated.

[14] This is the usual division, which seems, however, to lack philosophic justification; for we may if we choose add tertiary and quaternary.

[15] Its bare existence (regarding this as a real attribute) relates it to every other existent without exception.

[16] These obviously relate entities to mind; whether this holds true of all existents is, of course, a familiar problem.

[17] Cf. again the "natural rights" which every one is supposed to enjoy, with the special claims and duties imposed by a definite status in a well-ordered society, and exemplified, e. g., during the War.

I think that this monistic or idealistic principle plainly holds true of every *static* system, whose equilibrium indeed consists essentially in this relation, at once universal and diversified, between every constituent and the whole; but the universe is dynamic,[18] and from this (it appears to me) a further fundamentally important result must logically follow.

5. Every complex system, we have seen, is, in virtue of all its attributes taken together, in connection with wider or narrower regions of the Whole. And further, each of its attributes or properties, considered separately, relates it to as wide an environmental sector as is possible for it to do—each is earmarked, as it were, for this purpose. As a result, every system is connected, in virtue of its complete intrinsic character, with an environment as general and extensive as is possible. Therefore, if we now assume any increase whatever in the system's complexity,[19] this must take the form of the development of some new characteristic, additional to those which it already possesses. But since, further, its existing properties already relate it (as has just been shown) to a range of environment as wide as is possible, the newly developed attribute can connect the system only with some sector of the external whole which is more specialized and restricted than any hitherto —simply because to all wider sections the system is related already.

But in actuality such an increasing complexity is never restricted to one, or to some few systems, but occurs universally;[19] which universality then implies further, as regards any given system, that there must be an increasing restriction and specialization on both sides—both in any

[18] Change, whatever the difficulties as to its ultimate reality, was postulated at the outset (*ante*).

[19] I endeavor to show below that such an increase is something more than a mere assumption, and an actual fact—that it is a necessary feature of the changing Whole.

given system itself, and in the whole of its environment. For every individual—every natural entity—is (in the first place) specialized in some degree—is a more or less localized element in the systematic whole. Every advance, therefore, in its complexity, especially when this occurs *pari passu* with a similar advance throughout its environment, must mean constantly higher specialization, and therefore increased localization and restriction—sensitive response to ever narrower and narrower spheres of the environment.

And thus the first result which (I think) is directly deducible from our initial principle of the systematic nature of changing reality, is that the highest and most valuable entities in the world (for these are generally the most complex and specialized)[20] are also—necessarily and inevitably—the rarest and the most restricted, both in occurrence and in range; while on the other hand, the more wide-spread, general, and diffused are any systems, the lower and simpler must be as a rule their category and value; so that what at first sight certainly appears to be a lack or a positive defect in the character of the real is found to be a direct and inevitable result of its inherent and systematic nature.

And this view again enables us to perceive the error of antagonizing—of creating antitheses between—different categories, which when thus judged by their degrees of complexity and value, are found to be relatively higher and lower. Such false contrasts are those which have been maintained between soul and body, life and matter, citizen and State, religion and morality, and others equally familiar. It must be ever futile to attempt to "reconcile" these, simply because there is no real opposition between them. Their difference, which is erroneously regarded as conflict, arises from their respective degrees of complexity and value; and they should no more be opposed to each other

[20] But the total effect may nevertheless still be esthetically simple; this arises from the harmony of the constituents, whose complexity is revealed only through analysis.

proof of the actual *fact* of evolutionary advance—we must seek to show its inherent and logical *necessity* in the being and nature of the world—i. e., not only that it actually *does* take place, but further that it must necessarily do so.

We may begin, then, with the principle of the universal connection between cause and effect. If we consider this relation not in any of its particular cases, but *as* universal, then we are at once led to the familiar conclusion that the real ground, or complete cause, of any given total phase in the world's development, lies in its previous condition also taken as a whole. But this result again is plainly only another aspect of the principle of the systematic—inter-related—character of reality, of the changing Whole as exhibiting an individuality which throughout is systematic but always incomplete, for at every moment it is itself the condition of its succeeding phase. Our question thus plainly takes the form: Is there between these succeeding total phases any inherently necessary universal relation? That each is throughout determined by its predecessor is certain; can we go farther and ascertain anything equally definite as to the universal mode[21] of this determination?

If we take into consideration the precise manner in which, in actuality, this universal causal determination always manifests itself, I think we may—that is, as a sequence or chain of distinguishable causes and effects always in their details (as science has shown) exactly relevant to each other. And therefore in order properly to apprehend the true nature of causal determination, it is necessary to perceive that this has always two distinct aspects, to each of which its due weight must be given. Every separate instance of cause-effect relation, that is, must be considered[22] as being essentially one constituent of

[21] I. e., as distinguished from the bare fact.

[22] I. e., from the philosophical standpoint.

the *total* causal determination of each phase of the whole by its predecessor; and to regard it, apart from this, as a phenomenon wholly separate and independent is to make of it merely a false abstraction. Certainly science must, to be successful, lay an emphasis (which is, however, philosophically illegitimate) on one of these aspects only—i. e., on each separate causal relation *as* separate; for no experiment could be attempted were the whole universe considered as determining it. But this scientific necessity is a philosophic defect, and from it there arises what is a well-recognized fault of causal explanation as generally presented—its being always infinitely retrogressive—every separate cause being only a link in an endless series, and never itself final and complete. But this defect is merely the logical result of the false isolation and narrowness of all scientific causes without exception; it is due to our losing sight of the truth that the only cause which can be truly final is nothing less than the Whole itself.

8. But the assertion that each phase of the universe is determined by its predecessor must obviously mean that every static system[23] derives its concrete character from the nature of the Whole, and in this respect itself expresses that nature; every thing owes its own particular character in the end to the nature of the Whole. The inner structure of every system being the result of all previous changes, its stability and equilibrium must obviously depend upon, and be responsive to, the sum total of its environing conditions; never for a moment is it severed from and independent of its total environment, which thus determines equally the maintenance, or the cessation, of its static equilibrium—i. e., of its persistence as a system (for science) or as an individual (for philosophy).

But science is interested, for obvious reasons, rather

[23] Which can, of course, be only relatively—never absolutely—static.

in the alteration than in the maintenance of equilibrium,[24] in change rather than in quiescence; so that it remains to consider the implication of the truth that every change is (not merely a consequence of some prior restricted change but) a response to *alteration in the total environment.* Only by taking this universal view can we avoid the futile infinite regress which the ordinary cause-effect sequence always involves.

If, then, we consider any system S,[25] we must recognize, (*a*) that it has attained its actual concrete structure as a result of all previous change; and (*b*) that while it retains this structure unaltered, the maintenance of its equilibrium is responsive to the totality of the conditions in its environment.[26] This being the case, I think it follows quite logically that when any change to which it is sensitive occurs in its environment, then, since S is *ex hypothesi* complex, its various parts must respond differentially to the single stimulus from without. We may cite as illustrations crystallization within a matrix cooling as a whole; or the effects upon a nation of a declaration of war.

But this differential response really means that there arise within S new subordinate systems which (although S was already systematic) did not exist, as such new systems, before; and this results, necessarily, in an advance in the systematization of S—in its increased specialization and heterogeneity.

[24] But the less so as science becomes more concrete; while still higher levels of culture—history, art, religion—are concerned with complex and stable systems as such.

[25] Which must always have some degree, high or low, of complexity; and also if the system remains a system in spite of change, some potentiality; this latter condition excludes from consideration all destructive change, which, however, comes indirectly within the scope of the argument.

[26] This principle tends to be left out of account, or at least fails to receive due emphasis, in two respects, (1) we regard change, rather than quiescence, as responsive to stimulus, and (2) we relate every system to too narrow and limited an environment; its real environment being nothing less than the Whole.

And such an advance, again, must be continuous without any assignable limits, for three reasons: (1) the stimuli which affect every actual system are many and varied, and each of them contributes its quota to the final compound result; but (2) what is still more important, as new systems originate within S, every further change within S is to some degree a change *outside each* of these, and so tends to induce *within* these still further systematization and complexity, *ad infinitum*; and finally (3), S itself must affect reflexly its own environing systems; what are effects within S become causes outside it; for it is itself part of some environment, so that the higher complexity induced within passes outward again and brings about correlative responsive advances in systems outside itself.[27]

Thus we appear to have proved that since the universe is systematic throughout—is interrelated, interconnected, and everywhere governed by law—therefore a continuous advance in complexity, in heterogeneity, in value, is (not only actual but) logically inevitable and necessary. All the diverse values of the universe, of whatever kind, are thus conserved and increased; all destruction really subserves reconstruction; and though this principle in itself may not be sufficient to prove indubitably that the Whole is swayed by Mind or Spirit or Personality, still it does (I think) enable philosophy to refuse to entertain pessimistic views as to the future of mankind and the world.

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[27] E. g., a state of war converts all nations other than the belligerents into neutrals with positive rights and duties.

THE STATUS OF THE CATEGORIES.

THE nature of the categories has been much obscured in the past by the efforts of Kant to meet Hume's sensationalism. Both Kant and Hume were geniuses of the first water and did in the way of analysis all, and more than all, that could rightly be expected of them by their most fervent admirers; and yet they could not accomplish the impossible.

I am compelled to criticize the tendency of this eighteenth-century movement as in many ways perverse. The story is an old one, and I shall refer only to essential points. Hume reduced reality to a manifold of passing elements which had no permanence or sameness. *In other words, he clearly saw that data are not physical things,* and yet he was so much influenced by Berkeley's idealism that he was unable to work out a theory of knowledge of a realistic sort. To a Humean, we can only offer our own critical theory of knowledge, which is neither naive realism nor a copy-theory. I presume that Hume would have admitted our possession of such categories as identity and permanence but would have denied their applicability to anything in human experience. The assumption that there was anything validly to apply them to was an illusion. But the critical realist would retort that we rightly apply them to objects of perception which we affirm, not to the contents of perception, Hume's impressions.

Kant started from the fact of knowledge and proceeded

to analyze the contents and implications of scientific knowledge. This was an excellent method of approach to the problem; but, unfortunately, Kant had not achieved an adequate epistemology and so was led to distinguish between phenomena present to, and formed by, a universal, logical mind and the inner flow of sensations in an individual mind. This logical mind supposedly forms its objects, and so knowledge finds what mind has already contributed. As is well known, Kant postulated an original manifold of sensations somehow passively given to the mind. The logical mind was thereupon regarded as a machine which actively wove these sensations into an ordered pattern. The pattern was contributed by the mind and was mental.

Kant's phenomena are really contents and not objects. Although he is an empirical realist, he is not a physical realist. Or, to put it otherwise, these phenomenal contents which he takes to be objects are constructs related to the postulated synthetic ego and dependent on it. Kant is an idealistic naive realist, that is, he does not want to drop back into psychologism with Hume, and yet he is convinced that what is given is mental. To put it frankly, he was puzzled. No one can read the *Critique of Pure Reason* without feeling that. He tries to keep the realism as against the percipient, while admitting the idealism in relation to a logical ego. It is this "objective" idealism which modern idealism takes refuge in. Unlike Hume's sensations, the Kantian phenomenon is thought of as permanent and identical. It is in this similar to the *thing* of naive realism, and yet it differs in that it is relative to a logical ego.

In accord with most critical thinkers to-day, I would disavow both Hume's atomism and Kant's logical machinery. As James Ward puts it, "Thinking is doing, and like all doing has a motive and has an end. Kant's *logical* ego functioning spontaneously out of time is but a chimera

buzzing in a vacuum and feeding on second intentions; that it is the thinnest of abstractions, he himself allows."[1]

What we must commence with is the field of the individual's experience as it is concretely given with its structure and empirical content full upon it. Genetic logic and genetic psychology can study the growth of this complex experience from humbler stages, but they find no reason to assume either a disconnected manifold or a spider-like ego, however far back they go. What they will discover is greater simplicity of structure and fewer distinctions.

Strictly speaking, epistemology is a critical science which studies the meaning and claim of knowledge at the level of adult experience in the light of what are decided to be inevitable and well-grounded distinctions. Hence, this genetic approach is not absolutely necessary to it. Yet it is confirmatory and suggestive, and enables the thinker to throw off the incubus of the old controversies. *I would not be understood to belittle the value of a keen insight into the logical development of modern philosophy.* I do not believe that any one can go far toward the solution of these problems unless he appreciates the formulations, rejections, successes, and failures of past thinkers. He must have the ability to hold past and present together in a synoptic way, and yet possess the vitality that is not overwhelmed by erudition. In other words, he must be able to put his finger upon the genuine problems and grasp the best setting for them that philosophy and science have made possible by their growth.

The individual's field of experience is, I take it, but another name for what the psychologist calls consciousness. The common thesis of critical realist and psychologist is that this changing field of experience is a structural whole which is a function of the organic individual in active rela-

[1] Ward, *Naturalism and Agnosticism*, 4th ed., p. 481. I am glad that I can agree so largely with Ward on these points.

tion with his environment which consists of inorganic things and other persons. It is *within* this organic individual as an expressive part of it that consciousness arises. Personally, I do not care whether this organic individual be called a subject, or a self, or what it is called, so long as no unempirical notions are surreptitiously introduced. I prefer to call it an organic individual or a psycho-physical organism because these terms correspond to our knowledge of it and do not preclude the intussusception of all that the terms subject or self can justly add. Let me admit that idealistic philosophy was far from wrong in its protests against associational psychology and against the *reductive* mechanistic views of biology. *It was right in its empiricism; it was wrong in its transcendentalism.* But is not this old battle a thing of the past whose fruits have been appropriated by the younger generation? The sharp contrasts of the past have given way to a deeper outlook. The time is ripe for the interpretation of this massive growth. It is my contention that evolutionary naturalism, on the metaphysical side, and critical realism, on the epistemological side, are the logical philosophical formulations of the actual *Weltanschauung* of the present.

Epistemology stresses what psychology has neglected, viz., the structural or formal side of consciousness. I presume that it puts its finger on a common weakness of past science, its neglect of pattern or organization. Psychology has been largely reductive and analytic. It may be that psychology can thus best meet the special problems in which it is interested. Nevertheless, philosophy must examine the structure and important distinctions of the individual's field of experience. These are facts as real as any to be found in biology. This descriptive empiricism, dealing with the structure of the whole of consciousness as it is concretely given rather than with the hypothetical elements into which *abstracted parts* like ideas and perceptual com-

plexes can be analyzed, is the true foundation of epistemology.[2] Such descriptive empiricism has nothing in common with what continental thinkers call psychologism. It does what psychology has neglected to do; it enlarges psychology, if you will. And I take it that this is what modern philosophy has really accomplished. Unfortunately, the Kantian tradition with its consciousness-in-general and its neglect of the individual was often too strong for it.

This large structure of concrete consciousness is just as common to various individuals as is the structure which the biologist finds in an animal species. This commonness of structure, however, no more conflicts with mental pluralism than does the common structure of individuals of a species conflict with the numerical distinctness of the individual organisms.

Now with the addition of this descriptive enlargement of psychology, critical realism reaffirms the belief of both common sense and psychology that consciousness is a function of the organic individual in interaction with its environment. But against naive realism it holds that this environment is not apprehended. The knowledge situation is more complex than naive realism supposes. New distinctions must be added. In other words, knowledge is not conceived *as an act of awareness* of an object literally presented but *as a structural system of contents and affirmations.* Knowledge of physical existents can be only grounded information assigned to affirmed objects as revealing something about them.[3]

If the individual's field of experience is a growth which reflects—if it does not do more—the active interplay of organism and environment, we need not be surprised to find that it contains distinctions of significance. Let us

[2] Cf. *The Essentials of Philosophy,* Ch. 8.

[3] Cf. an article in the *Philosophical Review,* September, 1918. This interpretation of knowledge does not conflict with the existence of less critical views.

mention a few such distinctions which we shall later analyze.

There is, for instance, the idea of particular physical things. These things are qualified as permanent and self-identical. These are the categories which we saw puzzled Hume who could not find anything which justified their application. We know that they apply to existences which cannot be literally given but which are represented in a way by data. The origin of these categories is fairly clear to the psychologist of to-day. They are quite obviously not contributions of a logical ego but meanings which reflect concrete experiences. The individual senses his own permanence and recognizes the same content again and again which he instinctively treats as the object to which he is reacting. Thus the sensible things of naive realism are complexes of contents which move together and behave in describable ways. Their self-existence is partly modeled on that of the self and their independence means that they are things to be reckoned with. Thus these preliminary categories grow up in a natural and empirical way.

These things are perceived as in spatial relations with one another; they "act" upon one another; they change in various ways. The bodily self reacting to them is considered one of them, and its experiences of willed action and passive influence are the material for much of the first idea of these categories. It is only later that such categories are critically examined and adjusted to what is actually known about physical existents. Probably the critical refinement of the category of causality illustrates the status of the categories as well as any. Much of the feeling content has had to be elided.

How natural these distinctions built around "things" sound! How inevitable they seem to us to be! And yet they are growths whose psychological basis and stages we can in a measure trace. They are expressions of the inter-

pretative drift of consciousness under the play of organic instincts and external stimuli. The presentational content —itself a growth of sensori-motor processes—is seized, as it were, by interests focalized in the self. This presented field suggests a division into complexes which hold together, move together, and threaten or entice the self. Thus are empirical things differentiated and interrelated.

Within the field of the given, therefore, the growth of a clear pattern appears to be the function of a process in which two complementary factors work: change of position of complexes on their own initiative, and the attention to these complexes in a unitary way as a result of interests such as desire, curiosity, and fear. Because these complexes are not under the individual's direct control, they are regarded as external things and secure motor meanings. They are co-real with the self; things to be reckoned with; objects which have consequences for weal and woe. Thus this empirical structure of consciousness has an origin of the most natural sort. It rests, on the one side, upon characteristics of presentational complexes, their groupings and changes, their independence of direct control; on the other side, upon selective interests of the self.

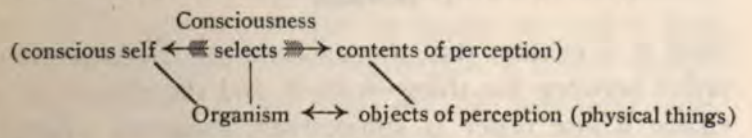
Philosophy has laid great stress upon this distinction between the self and the not-self. Yet it has failed to give it the concrete setting which is desirable.[4] It must be remembered that the not-self is a term for a plurality of things not felt to be essentially different in kind from the self. The contrast held in mind is self as a conscious center of action; and this self is from the first a bodily self. What we should stress is the fact that we have here

[4] Cf. Ward's quotation from Ferrier, *Naturalism and Agnosticism*, pp. 491-2. Ward tries to kill dualism in this fashion. But this pattern within the individual's consciousness has nothing to do with dualism; *it has to do with the indication of pluralism.* Each self feels itself confronted with many co-real things. I am inclined to think that the inability to distinguish between content and object of perception together with that abstraction, consciousness-in-general, account for much idealism.

a pattern within the consciousness of each individual. The self notes factors in their relation within consciousness and so achieves the category of thinghood. It notes sequential changes in one complex after another has moved toward it and come in "contact" with it, and soon arrives at the idea of causal interaction. The setting of these primary or common-sense categories is very concrete. The active self selects and seeks to control; it notices alterations of position; it remarks changes. It is one thing among others intensely interested in them and their possibilities.

Of course, the development of these primary categories takes time. They are growths; and yet, I think, inevitable growths. It is absurd to attempt to deduce them from an abstract understanding. They are products of the character and behavior of the sense-continuum in relation to the self as active and interpretative. Spatial and temporal order are features of the complexes which are given thinghood; and causality is the spatio-temporal interaction of these things. The framework is objective, and, if the self introjectively gives a tang and affective atmosphere to it, this subjective coloring can be withdrawn without injury to what is cognitively essential. The conscious self does not spin the categories from itself.

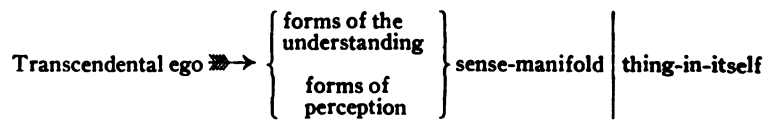
But it is time that we gave this development within experience its realistic setting. The parallelism between the object of perception and the interested organism, on the one hand, and the content of perception and the conscious self, on the other hand, needs to be borne in mind. The following diagram may suggest the situation:



The foundation of the growth of the field of experience is the interaction of organism and environment. This situa-

tion is symbolized in the diagram by the double-headed arrow. Corresponding to this active relationship, and expressive of it, is the structure of consciousness indicated above the organism. While the relation between the organism and its environment is causal, the relation between the conscious self and the contents of perception is not overtly causal in the same sense. Yet it is an undoubted fact that the conscious self is influenced by the contents of perception and that the contents of perception are selected more or less in accordance with the interests of the conscious self. Overt changes in the content of perception (an empirical thing) can be brought about only by action of the organism. This diagram illustrates the control of the contents of perception by the objects of perception. It also makes clear the basis for the conformity of data and objects. It is just because objects are organized wholes which move as one that contents of perception behave in a corresponding way in consciousness. It is just because the relations of objects are spatial and temporal that the relations of content-complexes are likewise spatial and temporal. The whole situation suggests that controlled *correspondence of order* which critical realism affirms.

Let us now contrast this analysis with Kant's schema. As nearly as I can make out the main drift of Kant's outlook—every one acknowledges that he hesitated—it is as follows:



Now it is evident that there can be no correspondence of order between the thing-in-itself and the *objects of experience* whose order is subjectively assigned. Kant shut himself into agnosticism by his very approach. Kant's schema follows the working of a machine into which raw

material is fed and there worked up. But is not the analogy completely false? We have to do with an organism *with remarkable capacities* under complex stimulation.

The need of the organism is to achieve a presentational pattern corresponding to the physical environment to which it must adapt itself. I do not think that it is far-fetched to suggest that consciousness is an instrument of that adaptiveness or *Zweckmässigkeit* which characterizes all organic life. The facts indicate that the organism selectively receives stimuli in their real order and transmutes them into sense-data of a corresponding order. Association by contiguity assists the construction of this internal pattern, but the method is not entirely passive. Recognition of the same objects of perception enables the organism to test its constructions again and again. There is nothing of the pure machine in all this. It is more like the fulfilment of a set task. It is the effort of the organism for its own safety to shut out the arbitrary and purely subjective. As I put it in an article, "The brain is sympathetic with reality and, like a skilled lawyer, draws out its story and puts it into its own language."[8] It is the actual situation of the organic individual which leads to the conformity of the pattern of empirical contents with physical things. It is the need of the organism which makes it objective in its methods.

The higher levels in consciousness bear witness to the same aim. The conscious self identifies, discriminates, analyzes, compares, notes implications, traces relations, etc. What it does is to bring out the pattern in all its complexity. It does not change its material, it studies it; and it finds assistance in repetition, experimentation, a larger experience. *The activities of the mind are like ingenious tools, they further the aim of the organism.* Not by passivity but by the right sort of activity is the correct pattern

[8] *The Philosophical Review*, September, 1918.

reached. Realizing this, we stand on the shoulders of Hume and Kant. We have risen above the yearning for a passive transmission of the world into consciousness. But in so doing we have risen above both naive realism and the copy-theory. We can be realists and yet appreciate what idealism felt to be a truth, the part played by mind in knowledge.

Yet this mind is not a disembodied mind. It is not a logical ego nor a transcendental self. It is the mind of psychology and logic; it is the brain-mind sensitive to stimuli and transmuting them into presentations which arouse in the same brain-mind interests, focused in the conscious self, and operations of both an analytic and a synthetic character. This brain-mind is an instrument of the organism and it employs consciousness as a medium and means for the transmutation of the macrocosm into a correspondent microcosm. And this cognitive side of the mind is, as we all realize to-day, an organon of the affective-volitional tendencies of the organic individual. But we must not forget that what is at first almost entirely a means can become an end desired for its own sake. The desire to know is now a prime desire of civilized man.

Knowledge is, then, a function of the *capacities of the organism,* many of which are experienced in consciousness, and the *physical things* the organism selects as objects and therefore controls. These are the ultimate conditions of knowledge. And it must not be forgotten that knowledge has two distinguishable levels: (1) of contents correlated and identified with objects of perception, and so cues for conduct; and (2) propositional contents, developed upon these, yet held to be mental and distinct from the objects of perception and thought which are affirmed, and informative of them. Naive realism tries to carry through the first outlook; critical realism to explain the first and advance to the second.

Because much of objective idealism took its departure

from the Kantian tradition, it tended to think of the categories as conditions of knowledge in the sense that a non-natural mind must contribute forms and relations from itself. We see now that it confused mental capacities as instrumental to perceptual and judgmental content with a contribution of forms from a hidden ego. In contrast, the critical realist asserts a bio-psychological process.

Hegelianism tried to escape that inner dualism which Kant had adopted as a way of escape from Hume. So far, so good. But this immanent deduction of the categories from one another by the dialectical method has never been successfully carried through. The categories are actually discriminations expressive of the situation of the psycho-physical organism. They are distinctions to be *discovered* within the individual's experience in an empirical fashion. The whole ideal of *deduction* seems to me fundamentally mistaken. We must add that Hegel, no more than Kant, solved the epistemological problem. His rejection of the thing-in-itself was based upon the meaninglessness of an absolute unknowable and not upon the insight that we can possess knowledge of that which is not an element within experience. The Hegelian has always shown a timidity in facing the problem of perception as a consequence.

In its actual working, objective idealism—whether neo-Kantian or Hegelian—has discovered the categories in the object of thought instead of in the subject. Why? Because that is where they develop. A careful student of idealism writes as follows: "As a matter of fact, objective idealism has deduced the categories from the object and not from the subject. To deduce the categories from the subject, it would have been necessary to define the subject—which the idealist has consistently omitted to do. The subject has been a bystander, whose familiar presence has gradually assumed the appearance of indispensable necessity... The idealist deduces the categories from the subject *in so*

far as conformed to the objective nature of things, and thus, in the last analysis, *from* the objective *nature of things.* The actual subject, then, does not impose necessities on nature, but yields to necessities which are dictated to it by something beyond itself."[6] In its actual implications, therefore, much of idealism is idealism only in name. It is for this reason that many religiously inclined thinkers speak of objective idealism as closely allied to naturalism. And so it is. It is a naturalism *manqué.* It is this because it never conquered its Kantian beginnings, the idea of constitutive thought, a universal mind, the object of knowledge as given in experience, etc. In short, it was reared on an inadequate epistemology. We shall see that even the pragmatists have not escaped from that magic circle called *experience.*

It is not too much to say that modern philosophy shows an unsettled view of the nature and function of mind. And yet the growth of philosophy in the light of modern biology, psychology, and logic is bringing a remedy to the vague ideas of the past which repeated such terms as relations, synthetic unity, and coherence in a semi-ecstatic way.

Pragmatism and neo-realism have supplemented one another in this advance, pragmatism showing the concrete setting of thought in the position and capacities of the human organism, while neo-realism stressed the actual operations of analysis and synthesis which are performed in consciousness. It is now seen that reflective thought follows "leads" in presented material, that reasoning is a purposive solution of problems by means of ideas and that it involves the noticing of identities and differences. Neo-realism supplements pragmatism by its intellectualism, by its stress upon order, by its anti-romanticism. It adds the iron which pragmatism has at times decidedly needed. Both movements have turned their backs on Kantianism.

[6] Perry, *Present Philosophical Tendencies,* p. 160.

The actual process of thought is being located. The individual is coming to his own. The natural is seen to include mind. Thought is not a vague creative ferment, but a highly structural process which we can empirically analyze.

But this result confirms the outlook of critical realism. The neo-realist is right in his contention that knowledge must conform to reality, but he wants an identity of idea and thing. He makes thought into a literal presence or a selective apprehension of non-mental entities. He does not see, or will not admit, that thought as a structural process ends in thoughts or ideas which conform to reality as an independent control. He thinks of consciousness as either an act of apprehension or a peculiar inclusion of objects. He would not admit the distinction between the mental content of perception and the physical object of perception. Hence he is compelled to leave the organic basis of knowledge in the capacities of the organism unexplored. Like all naive realists, he is unable to do justice to all the facts of consciousness and is puzzled to account for error and illusion.[7]

Pragmatism, on the other hand, has worked out a more empirical idea of the structure of *thought as a process*. It has removed logic from the rather stiff philosophical setting which it retained even with such a critical thinker as Bosanquet. Whether it has added much logic in the process is a question over which there might well be dispute. But pragmatism never conquered the epistemological problem which it had inherited. Instead, it felt the strength of the drift toward realism and sought more and more to be realistic in a pragmatic sort of way, that is, by ignoring patient analysis and trusting to the right postulates. While valuable as a dissolvent of absolute idealism, it would have accomplished far more, and accomplished it more quickly,

[7] Neo-realism seems to be working away from its pan-objectivism. This comes out in Spaulding's *The New Rationalism*. But critical realism will be the logical terminus of such a movement.

such. Space as an abstract universal is exemplified by the specific instances. It is the common form or order. Events, or changes in physical things, happen in a peculiar order, the temporal. This order can be abstracted from its instances and studied as a universal. It is the common character of events, and, since physical things change, our knowledge about them contains this order as an internal form. Thus space and time are categories in that they are *characteristic elements* of the content of our knowledge about the physical world. They are not a peculiar logical type of being which somehow underlies the physical world. Once abstracted, however, they can become subsistential contents of awareness; they are, then, thoughts, not thoughts of.

Space and time illustrate very well this empirical doctrine of the categories. They are not physical things; they are not even peculiar elements of the physical world. They are characters of our knowledge about things. *It follows that the validity of the categories is bound up with the validity of knowledge.* They are not forms to be deduced from the self in some peculiar fashion; they are features to be discovered in objective knowledge, abstracted, and analyzed. Thus the objective idealist was right in his practical procedure. Unfortunately, the constitutive notion of the self vitiated his final interpretation. It is true, also, that he did not take some of the categories seriously enough. This depreciation is especially true of space and time. He wished to introduce the idea of value into the categories and to speak of higher categories and lower categories, degrees of reality, etc. Besides, the Kantian tradition that space and time are self-contradictory lingered in philosophy long after proper analyses of these categories had been made.

We have made it a fundamental principle that the validity of the categories is bound up with the validity of critical

knowledge about reality. But it would also be true to say that the categories are themselves instances of the most general knowledge about the physical realm. That things are in the spatial order is a knowledge-claim. And knowledge seeks to conform to that about which it is knowledge, to reflect *in its own medium* that which is reproducible about existence. But we have examined knowledge enough already to realize that it plays over existence connecting the past with the present, comparing things which have no very direct continuity, and in general probing nature. Knowledge conforms to reality in an active way much as an investigator conforms to his material. We shall see that the categories follow knowledge in this regard. They give, as it were, the structure of nature as this is projected into consciousness.

The categories appear first in experience as general characters of its pattern. This pattern is a growth which expresses a necessity to which the would-be adaptive organism is exposed. It is not a blind necessity in the mechanical sense; rather is it a necessity which is freely admitted as means to end. The mind of the organism must produce a pattern in consciousness correspondent to physical reality if it is to further the organism's safety. The result is apparent in what I have called the primary categories, viz., space, time, thinghood, and causality.

These primary categories arise at first in an uncritical form. It has taken much reflection on the part of both philosophy and the sciences to separate the objective essentials from the more subjective ingredients and so to achieve categories which are cases of general knowledge about the physical world. The history of causality is, perhaps, the most instructive example of this clarification.

Other categories arise in connection with these primary categories as knowledge is enlarged. Mass and energy as quantities, conservation as a character of these quantities

in nature, and evolution as the genetic side of many empirical substances are examples of later categories which develop and amplify the preliminary categories. These new categories are at once the general features and signs of a fuller knowledge of the world. Their history can be completely investigated since they arose in modern times. Their origin in the data of experience can readily be traced. They are discoveries and not deductions, and yet they are discoveries which require reasoning and precise reflection.

Like all universals, the categories are at once discoveries and standards. Our past experience assumed the temporal and spatial pattern and fell into things causally interacting. Whereupon science marked these features for her domain and formulated her laws in terms of such universal characters. Any thing or any event is expected to obey this framework which has been built up from a wide experience. A thing is assumed to have mass and to be in a definite position or in motion from one position to another; an event is assumed to be a function of antecedent conditions. In this sense, the categories are postulated to apply to all possible experience. They are guides for the mastery of new instances, of complex and tangled fields. Particular laws cannot be deduced beforehand, but it can be maintained that these laws will come under the categories. In this sense, they apply to all possible experience.

The question has at times been raised as to what guaranty there is that nature will recognize the categories. Kant, it will be remembered, tried to meet this difficulty by having the categories make nature. But he could give no guaranty that the ego and its forms would not change. The critical realist meets the difficulty in a different way. The categories are cases of general knowledge about nature resting upon the control by nature of the objective data of consciousness, a control actively furthered by the organism. Hence, nature itself would need to change before

they would become invalid. And while we must admit that we cannot demonstrate that nature may not abruptly change its objective order, this thought is essentially unmotived and can hardly be entertained seriously by any one who realizes the massiveness of nature and the fact that particular changes are expressions of that which changes. This hypothetical catastrophe assumes an uncaused change and so conflicts with our actual knowledge of nature. It should be noted that any gradual change in nature would be reflected in the categories.

In conclusion, attention must be called to the two general classes of categories, the epistemological and the metaphysical. Space, time, causality, organization, conservation, energy, etc., are metaphysical categories, that is, fundamental concepts characteristic of our knowledge about nature. In the following articles we shall deal chiefly with this class of categories; but, if we are to secure mastery in philosophy, we must also bear in mind those categories which concern knowledge. We must be able to get the correct interpretation for such terms as subject, object, idea, awareness, datum, phenomenon, consciousness, etc. We must be able to appreciate the structure of consciousness, its distinctions, claims, and affirmations. It is this that critical realism claims to do. It is a realism which stresses mental process, which regards the mind as an organ of the psycho-physical individual, which relinquishes the myth of a mysterious act of apprehension overleaping the boundaries of space and time, which realizes that knowledge is resident in consciousness. In this way, the epistemological categories harmonize with the metaphysical categories. Critical realism of this naturalistic type has no room for a disembodied knower.

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LOGICAL FICTIONS.

I. WHAT WE KNOW AND HOW WE KNOW IT.

I.

IT is not easy to say what it is we know and how we get to know it: to do so, we must first face other questions which in our ignorance we answer in various ways. Our chief foe is common sense that takes so much for granted. Many take the common-sense view that just as water is water, so thoughts are thoughts and knowledge knowledge. That's good enough for them; they do not feel the need for more.

But a few feel they must look more closely. In all ages, perhaps, men have tried (without much success) to analyze "knowledge" and to understand how we get it; but in recent years progress has been so considerable that any one interested in the subject now starts with the great advantage of having a large number of obstacles removed: many of the prejudices of common sense have gone forever, and, to some extent at least, the way to an answer has been pegged out.

Any one who wishes to reach a satisfactory explanation has to do some strenuous thinking for himself; but that the goal is (if it is) now almost in sight, is due to the labors of many hundreds.

But if a writer on this subject must have a strenuous time, so must the reader, for the writer may take points of view for granted that are new to the reader, and it is always difficult to follow an argument in which too much is taken

for granted. In order to prevent this as far as possible, it will be necessary to solve some of the more important difficulties offhand and dogmatically and to start with certain assumptions, leaving detailed treatment for later chapters. Just as it is not possible to do much geometry without accepting some definition of point and line, so it is not possible to get far in epistemology without *starting* with certain assumptions; it will be seen later that the only assumption we have to make is that *it is necessary to start.*

For the present we must use the common-sense phrase "to use one's senses." We cannot, of course, leave it at that, but it will do for the moment.

"Space" and "time" in the common-sense meaning are as irrelevant to our problem as a sheet of paper to the sum that is done on it. It is important to realize from the outset that common-sense ideas of time and space are merely useful habits that express in a crude way certain subtle differences in what we call "here" and "there": if used for analysis they are grossly misleading. It is, for instance, misleading to speak of the present as if it were time at all like past and future: it is only the locus of abstracts that do not exist in time. The future and the past are two aspects of the same time which is the locus of all instances of numbers (*inter alia*). The moment these instances are recognized as individuals they are localized in space.

Common sense misleads us even in the use of our senses. It is hard, as a rule, to get ourselves to look at what we see; usually we look only at what we think we see—a different thing altogether. When we look out of a window, we fancy we see things at various distances, but we don't. We see nothing but many colors and shades.

Again: most of us think that we are bound to see what we think we see. There may be cases, we admit, where we "see wrong"; but we feel that the thing was there to see all the time. It is a little hard to persuade ourselves that

explanations. Any light, sound, or pain that cannot turn into an explanation terrifies us. And because we all explain, we think that we explain rightly—it is hard to convince ourselves that the function of an explanation is not to explain but to satisfy. Neither peasant nor scientist can explain light; both find a solution that satisfies them; if a peasant finds it easy it is because he is easily satisfied. When an apple falls from a tree, is it natural? is it weird? You may say "Of course it falls—what else should it do?"—or "gravitation, of course"—or anything else you like. It *is* weird; but for the sake of sanity, you must explain away the weirdness, so that it seems natural and you feel at home, master in your own world.

If, then, we all read the face of the world just as we read a book, seeing symbols and by their means making a mental construction which we call reality; and if we all instinctively veil as soon as possible anything mysterious or inexplicable with an explanation in order to feel masters of the situation: do we have to learn to read the external world just as we learn to read a book? Obviously; and, fortunately, when we are very young we have plenty of time.

The question remains: How do we learn to read at all? It seems such a natural, homely thing that most of us are satisfied with the "explanation": "Oh, well, we all just learn." It is extremely difficult to explain how we come to know for instance what the word *dog* stands for. We all imagine that we see hundreds of instances of *dog*. But who ever "saw" what *dog* stands for? All visible dogs are symbols: what *dog* stands for is invisible even to the mind's eye; "a dog," being only an instance, is visible only to the mind's eye; and this dog, Fido, is a group of symbols visible to the eyes.

There is a matter here which it is important to deal with: we find it hard to get rid of the idea that behind some

symbols there is what is called "the real thing." We are apt to think that we have, as it were, a scale, starting from symbols that are what may be called "exactly like," to symbols, like a printed word, which are "nothing like." And if a living dog, that we see, is a group of symbols, why are some symbols more "real" than others? It will be easier to see this difference if we first make sure of what we mean by counting. It is commonly supposed that it is possible to count things—trees, tables, coins, and so on. And not only that; we are supposed to be able to count them by merely looking at them or "ticking them off." Yet it is easy to find two tables, for instance, that have *absolutely nothing* in common, except a very-hard-to-define tableness. A table is a table because it answers to your (or some one else's) idea of a table. There can be no doubt whatever that we never count "things": we count instances of thingness. If I say I see a house, what I *see* is a group of symbols which stimulates my idea of house. What I *think* of is, (1) house, (2) a house, (3) that house. Thought No. 3 is equivalent to a proper name for what exists in space. Thought No. 2 is of what exists only in time (past or future according to your point of view): it is an instance not only of "house" but of "one." Thought No. 1 is of what does not exist in time but only in the present, being, like what "one" stands for, an organized (perhaps it would be safe to say an organic, growing) abstract.

Now, what is this thingness—this organized abstract—that we can count when we come across instances of it? A pattern. Any object seen, anything heard, touched, tasted, or smelled is distinguished by a characteristic pattern. The external world is, let us say, nature's writing. If we see written the word "Bill," it has, we say, a number of meanings. For a man whose name happens to be William—whose father and eldest son are also William—the word Bill is likely to be a very live symbol, even if it had

no other meanings. And the only reason why a "real" dog seems more real than (say) a picture, is because the real dog is a group of symbols that stands for more than merely "dog": it answers to a number of other very mysterious but quite obvious "thingnesses," like "life," "animal," "dangerous," and so on, to which the printed symbol does not answer.

We have, then, primarily an endless collection of symbols, and just as our hands can grip a handful which varies according to the matter gripped, so the mind can grip a pattern by which we prove experiences. If any experience proves to be an instance of the pattern, we can count it. By counting it, we have shifted it from an abstract present to actual time (past or future). We may then give the instance a name and place it in space.

Every pattern has, or could have, a name. The external world is not (so far as we know) full of things: for us, it is full of instances of patterns—most instances being parts of many other patterns. There are infinitely more patterns than instances—many patterns cannot even have one instance.

A pattern must not be thought of as something fixed. A pattern survives constant change by means of something very like personality: it is hard to say which is the more slippery and shifting, what the symbol "Bolshevist" stands for, or what instance will call for that description. In fact, one is tempted to say that the personality of the pattern is only a complicated relation: just as there can be no such thing as "angle" without its limits, so a pattern like Bolshevism is formed and contained, and like an angle it can have degrees. We all experience the sameness and yet the difference of a pattern: the first view may give us what is called "a totally wrong impression"—say, of Pussyfoot. But the important thing is not the "totally wrong" but the impression, which being abstract, exists outside time, that is,

permanently in the present. When we feel that the impression was totally wrong, it merely means that the pattern is like a swiftly growing crystal, or like capital at compound interest.

However difficult it may be to see clearly what a pattern is, it is easy to recognize an instance of a pattern. Who first thought of stimulating thought by symbols in imitation of nature, we do not know. Nature's symbols are essentially the same as the artificial ones we use (for instance) in language. If we read *wind* in a book, we know that we have only a symbol before us. Why is it that, when we read the symbol for the same pattern in nature, we imagine that we are doing more than reading symbols—and adding explanations?

These explanations must now be dealt with more fully and will be the subject of the following section.

II.

Before trying to reduce the number of assumptions we have made, let us repeat three important points.

1. Knowledge is founded on consciousness, which it is for physiologists to explain. We start with being aware. We start by being aware of something: before that, we were aware of nothing; since then we have never been (and can never be) aware of nothing—we can only be aware of something or something else. When we say that there is nothing in a box, we are merely stating that there is something else—not what we were thinking of. "Awareness" is, as we have said, for physiologists to explain—it seems to be similar to what is called chemical reaction or tropism. But there are various kinds of awareness: light is beautiful but it may hurt. It seems safe to say that normal human beings like light and hate being burnt. Knowledge depends not on being aware of the light or of the burn, but on connecting the two in one pattern. Like much else in nature,

this combining process seems to be a matter of chance and habit. Once the pattern is complete we wonder how people could have failed to see the connection: we now easily connect death with lightning rather than thunder. If, then, knowledge is founded on consciousness, it is built up on connections. Common sense is so misleading because it is full of false connections. Blankets keep you warm. therefore it must be absurd to wear them in a very hot climate. When the sun shines in a clear sky the heaven is full of light, therefore on the surface of the moon the sky couldn't look black if the sun were visible. And so on. By correcting connections and complicating them in the light of experience we advance in knowledge. A sum of such connections is what is represented in a word.

2. Mere awareness, say of light or a burn, seems to be similar to what a steel pen "feels" in the presence of the magnet. There seems to be a wide range of life that survives without more than awareness: food is accepted, and either digested or rejected. Knowledge starts when it is possible to satisfy ourself without trial. And it is only possible to do this if the sensations or feelings stimulate a connection or pattern, and not merely a reaction. An instance of this would be this: I see a bird on the wing and I want to shoot it; what I shoot at (if I am to hit it) is not the bird but a "pattern" which I form by means of a most intricate set of connections.

3. We are not here concerned with the origin of this intricate set of connections. For the present it is enough to see clearly that sensations in the widest sense of the word stimulate a reaction which requires an explanation to satisfy it, or, as we might say, to explain it away. We are held up by what we cannot explain away. For instance, in a battle the whistling of bullets arrests, until we "know" it: a man falls dead—a rumbling sound—flashes—utter stillness—lights at night—all these we can ignore, only if

we can give an explanation of them. The explanation may be quite wrong, but provided that it satisfies us, we call it knowledge. If we say that a solar eclipse is due to a dragon and the explanation satisfies—that is knowledge. The moment it ceases to satisfy, we require another explanation.

We shall now be able to see that all explanations are given in terms of motion: the fundamental explanation is roughly equivalent to what we call a present participle. "Something" is essentially thought of as being capable of being distinguished or *separated* from "everything"; a thing cannot be thought of otherwise than as "*being a thing*"; no thing can be thought of as permanent in time, but it can be thought of as permanent in the "present," but only because that is a timeless abstraction of permanent change. This permanent pattern which cannot exist in time is and must be thought of as something "picked out": the moment you see a pattern, you have got something which stands out; in other words, the rest—everything else —falls away from it. The pattern of the Great Bear is got only by thinking of those stars as being on a plane of their own. Once this property of "being" is grasped, it is hard to resist the idea that all "knowledge" is due to the fact that we move and that things move. How we perceive motion is a problem with which we are not concerned. The common-sense idea is that we see it—but it seems likely that we shall not have to wait long before it is proved that, although the eye obviously supplies a large amount of the matter to be read, it is the ear that actually reads the motion.

The process can be expressed symbolically. Thus, if a stands for something perceived, the next step is represented by $a-b$, indicating that we have thought of b as moved from a. Thus, if we perceive a tree (b) it is clearly taken out of or thought of as separable from everything else (a). If we take one step further we shall be able to

are called wrong. It is important to admit that, although it is *useful* to believe that right is right, right is really only an explanation that has not yet been found to be unsatisfying or "wrong."

Perhaps the easiest way of getting a clear idea of this "pattern" is to think of it as a diamond. "Cat" is a pattern that comes early in life, and we think we know a cat because it looks like one. We don't. We no more know a cat because it looks like one than we know a rough diamond because it looks like one. In both cases we tell by what is done, i. e., the duty we expect. Let us take only one duty: the diamond if cut will flash, the cat if stroked will purr. Other things flash and other things purr, but a diamond flashes in its own way and a cat purrs in its own way. And the interesting thing to notice is that if there were no light we could not recognize the "duty"; and if there were no surroundings or circumstances we could tell no duty. It seems that the duty is always in the circumstances and never in the pattern, just as what we see in a looking-glass is never in the looking-glass. That is why we said that what *dog* stands for is not visible even to the mind's eye. What is visible is what corresponds to the characteristic flash of the diamond—it is something characteristic in the surroundings that betrays the presence of dog. It is not hard to see that "any dog" corresponds to any facet of the diamond; "my dog" corresponds to one particular facet of a diamond that is continually being "cut" by experience.

[TO BE CONTINUED.]

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RICHARD BURTHOGGE, HIS LIFE AND HIS PLACE IN THE HISTORY OF PHILOSOPHY.*

A. THE LIFE OF RICHARD BURTHOGGE.

THERE are not many sources for the life of Richard Burthogge. The meager accounts by his biographers are based for the most part on the short sketch of his life quoted anonymously by Anthony Wood in the *Athenae Oxonienses.*

Burthogge was born in Plymouth, England.[1] The dates of his life are not definitely known, but are usually given as 1638-94.[2] As Georges Lyon[3] points out, however, the date of his death must have been later than 1694. It might be inferred from the fact that *Christianity a Revealed Mystery* was not published until 1702, that the date has been placed too early. This work, however, may have been posthumous. But the fact that *Of the Soul of the World,* a letter to Locke, is dated 1698, shows conclusively that the date of Burthogge's death must have been at least four years later than that given by his biographers.

* [The following is the Introduction to a new edition of Richard Burthogge's Philosophical Writings which will soon be issued from our press. —Ed.]

[1] Anthony Wood, *Athenae Oxonienses,* Vol. IV, p. 581. Georges Lyon, *L'idéalisme en Angleterre au XVIII. siècle,* p. 72.

[2] Leslie Stephen, *Dictionary of National Biography.* Georges Lyon, *loc. cit.* Ueberweg, *A History of Philosophy from Thales to the Present Time,* Vol. I, p. 365.

[3] *Loc. cit.*

More[10] and Culverwel[10] the most tedious of reading. And again, with the exception of the two works mentioned above, Burthogge's writings like those of the Platonists. are drenched with the theological views of the time.[11] And even the *Organum* and the *Essay* do not escape the religious bias of the seventeenth century.[12] But more specifically, Burthogge holds in common with the Cambridge Platonists at least two of their important tenets. His doctrine of the superiority of mind over matter is, with unimportant differences, the same as that taught by More and by Cudworth. And one of his doctrines of truth is in agreement with that of the Platonists, although he has a second teaching about truth which contradicts his own first doctrine as well as that of the Cambridge Platonists.

More and Cudworth, basing their teaching on Plato's *Timaeus*, held that not man alone, but nature as well, is dominated by a soul. They did not identify the soul of the world with God himself, but conceived it as an instrument in God's hands, made and used by him to manifest himself in the world.[13] Burthogge, on the other hand, seems to identify the "Mosaical Spirit" with the Spirit of God[14] diffused throughout the world, although he holds at the same time, that God is "Pure Mind," independent of all matter.[14] Burthogge's teaching also about the nature of the human soul is essentially that of the Platonists. More and Cudworth held that particular souls, i. e., souls of men and animals and even of plants, are "sprigs of the common soul of the world, but not the soul itself,"[15] though

[10] See Cudworth, *True Intellectual System*; More, *Antidote against Atheism*; Culverwel, *Discourse of the Light of Nature.*

[11] See *Causa Dei*; ΤΑΓΑΘΟΝ; *Christianity a Revealed Mystery.*

[12] *Organum*, Sect. 41; *Essay*, Ch. VII.

[13] Cudworth, *True Intellectual System*, edition of 1678, p. 150; More, *Antidote against Atheism*, Bk. II, Ch. II, paragr. 7.

[14] *Essay*, Ch. II, Sect. 2, p. 44.

[15] More, *Antidote against Atheism*, Appendix, Chap. II, paragr. 9; cf. *Immortality of the Soul*, Lib. III, Cap. 11-12, and Cudworth, *op. cit.*, p. 171.

it is unreasonable, Cudworth adds, to suppose that every plant and blade of grass has "a Particular Plastick Life." Similarly Burthogge call the soul "a certain Determinate Vital Energy....a certain Portion of the Spirit of the Universe Vested in a Body...."[16]

Again, in teaching that by intuition truth is attained, Burthogge is in agreement with the thought of his time. To the Platonists truth always meant religious truth, which is known, they believed, by intuition. The more completely a man can withdraw from the outer sensuous world into the realm of his own soul, the more certain is he of attaining a knowledge of truth.[17] And Burthogge likewise teaches that apart from all sensuous experience we know the form of truth, which we apply on the occasion of sense-experience, thereby determining whether it be truth or not.[18] Burthogge, however, holds an empirical theory of truth which contradicts this view. The criterion of truth, according to this second theory is based not on intuition, but rather on the objective harmony of things among themselves. Truth is not necessarily that which we "clearly and distinctly" apprehend,[19] nor that which is in accord with our faculties,[20] but that which fits in with the whole objective scheme of things.[21]

2. *Burthogge's Relation to Locke and to Kant.*

In spite of the abundant evidence in all Burthogge's writings of the influence of seventeenth-century thought, it is true that his theory of knowledge, his most important

[16] *Essay*, Ch. IV, Sect. 3, p. 150. Cf. *Of the Soul of the World*, p. 6; "....particular souls....are portions of that Spirit [Mosaical Spirit] acting in the several particular Bodies in which they are."

[17] Smith, *Discourse concerning....Divine Knowledge*, Sect. 1. Culverwel, *Discourse of the Light of Nature*, especially Chaps. IX and XI.

[18] *Organum*, Sects. 63, 69.

[19] *Ibid.*, Sects. 18, 68, 69.

[20] *Ibid.*, Sects. 7, 72.

[21] *Ibid.*, Sects. 75, 78. Cf. Sect. 16.

philosophical teaching, remains singularly free from Platonist influence. It will be noted that in the *Organum* there are scattered passages[22] in which Burthogge clings to the Platonic epistemology, holding sense to be the arch-enemy of the highest knowledge. But these occasional passages, inconsistent as they are with his usual teaching, form no integral part of Burthogge's doctrine of knowledge, which stands, untouched by Platonist influence, as a remarkable anticipation of Kant.

Far from holding that sense is a hindrance to knowledge, Burthogge teaches, like Kant, that it is one of the only two sources of knowledge. The essentials of Kant's epistemology are found in the well-known words: "Thoughts without content are empty, intuitions without concepts are blind.... The understanding cannot see, the senses cannot think. By their union alone can knowledge be produced."[23] And this is exactly Burthogge's teaching: "The Understanding converses not with things ordinarily but by the Intervention of the sense."[24]

Sensation, according to both Burthogge and Kant, is the passively received in knowledge, that which is given in experience:[25] "....the impressions of things without upon the Sensories produce or occasion in them the Cogitations which we call Sentiments, as Colours, Sounds, Sapour &c."[26] And as objects can be perceived only through sensation, so, Burthogge teaches like Kant, they can be thought only through concepts or "notions." The mind knows nothing, he says, apart from its particular "manner of conceiving things." "The Understanding conceives not anything but under the notion of an Entity, and this either

[22] Sects. 30, 32, 34, 35, 50.

[23] *Critique of Pure Reason*, A (1st ed.), p. 51; B, p. 75.

[24] *Essay*, Ch. III, Sect. 1, p. 60.

[25] *Critique of Pure Reason*, A 51; B 75.

[26] *Organum*, Sects. 24, 74.

a Substance or an Accident; under that of a whole or a part: or of a Cause, or of an effect or the like."[27] And again Burthogge is in agreement with Kant in his most important teaching that in order to have knowledge of the object the percept and the concept must unite. Neither alone is sufficient to give complete knowledge.[28]

The parallelism between Burthogge and Kant may be carried further. Burthogge holds not only that the object of knowledge involves both the sensational and the notional factor, but, like Kant, he teaches that it has no existence independent of thought.[29] Both teach that the object of knowledge is phenomenal, not real. That the sensuous content of knowledge has no objective existence was not an absolutely new doctrine even in Burthogge's time. Locke, like Descartes, had already taught the ideality of the "secondary" sense-qualities. But that the mind itself, independent of sense-experience, actively contributes to the make-up of its own object is a doctrine which, according to the usual view, was promulgated for the first time by Kant. Yet in the light of the teaching of the *Organum* and the *Essay* it is clear that Kant's own "Copernican revolution" had an instigator at least a century older than Kant.

To hold, however, as Professor Lovejoy holds,[30] that Kant's theory was the common property of the Cambridge Platonists seems hardly justifiable even in the light of the quotations given in support of this belief. What these quotations from Cudworth and More show is rather the tenacious belief in the superiority of mind over matter, and thus in the superiority of thought (in which matter

[27] *Essay*, Ch. III, Sect. 1, p. 57. Cf. *Organum*, Sects. 14-15.

[28] *Organum*, Sects. 9-10. Cf. *Essay*, Ch. III, Sect. 1, p. 59; *Critique*, A 50. 100, 109, 116; B 74, 146.

[29] *Essay*, Ch. III, Sect. 1; *Organum*, Sects. 8-13.

[30] *Essays Philosophical and Psychological in Honor of Wm. James*, pp. 272-278.

is subservient to mind) over sensation (in which the mind is affected by matter). Nothing was more abhorrent to the Platonists than the idea that matter could in any way *assist* mind. The passage quoted from Cudworth[31] is, by his own confession, simply an outburst against the "atheistic argument" that since matter exists in its own right without need of any creative mind, our knowledge of things depends merely upon "passive receptivity." This teaching was an outrage to the Platonists merely because it belittled the mind, making it appear of so much less importance than matter, and not because it ignored the necessary conceptual element in knowledge as taught by Kant and Burthogge. "But sensible things themselves....," says Cudworth,[32] "are not known and understood either by the passion or fancy of sense, nor by anything merely foreign and adventitious, but by intelligible ideas exerted from the mind itself, that is, by something native and domestic to it." These words of the quotation, italicized by Professor Lovejoy[33] to emphasize their agreement with the Kantian teaching, seem rather to show plainly that Cudworth is simply falling back on the familiar "innate ideas" theory in order to prove to the atheist that the mind is quite capable of getting on without any assistance from matter; that it would, in fact, fare much better could it be rid of sensuous perception altogether.

Burthogge, like Kant, falls short of idealism. He could not escape the influence of the traditional dualism of the seventeenth century any more than Kant could shake off the influence of Wolff's dualistic teaching.[34] Neither Burthogge nor Kant ever denied the existence of reality external to mind. But since they find that the object of

[31] *Ibid.*, pp. 272-74.

[32] *True Intellectual System, op. cit.*, p. 731.

[33] *Essays....in Honor of Wm. James*, pp. 273f.

[34] See M. W. Calkins, *The Persistent Problems of Philosophy*, p. 236.

knowledge has no independent existence, they are forced to hold that reality, conceived as the thing independent of consciousness, is unknown. This teaching about the unknown thing is emphasized by Burthogge in both the *Organum*[35] and the *Essay on Reason*[36]. And Kant includes it not only in the section on the "Antinomies"[37] in the "Dialectic," but anticipates it in all the other divisions of the *Critique*;[38] in the chapter on "Phenomena and Noumena"[39] of the "Analytic," and in the "Æsthetic."[40]

Burthogge's teaching about the nature of the thing is essentially the same as that of Kant. The "thing" is, in the first place, unlike the "object," non-mental and wholly independent of thought.[41] In the second place, the thing really exists. The object, Burthogge teaches with Kant, is only appearance or phenomenon, without reality.[41] And finally the thing, for Burthogge as well as for Kant, is unknown.[41] Thus does Burthogge, like Kant, unquestioningly and tenaciously hold to an external reality, a reality robbed, however, of all positive character save that of existence.

There is in Burthogge no explicit proof for the existence of the thing. That there exists independent reality was not questioned in the seventeenth century. And Burthogge, like his contemporaries, takes the "thing" for granted though he suggests the argument, later used by Kant, for the existence of it. Our sensations, he says, must have a cause; we know that we ourselves do not cause them; they must therefore have an external cause.[42]

[35] Sect. 9.

[36] Ch. III, Sect. 2, pp. 71, 73.

[37] A 357, 359, 361, 368, 378.

[38] See M. W. Calkins, *op. cit.*, p. 237, footnote.

[39] A 250, 253, 258; B 300, 303.

[40] A 24, 42, 44f, 49; B 38, 59, 61f, 67.

[41] *Organum*, Sects. 9-10.

[42] *Essay*, Ch. III, Sect. 2, p. 73, cf. pp. 74f.

Kant several times in the *Critique* implies this causal relation between the phenomenon and the thing.[43] "The understanding," he says, "....forms the thought of an object by itself, but as transcendental only, which is cause of phenomena."[44] This doctrine is formulated even more explicitly in the *Prolegomena*: "I grant....that there are bodies without us, that is, things which, though quite unknown to us as to what they are in themselves, we yet know by the representations which their influence on our sensibility procures us."[45] That the thing or reality is unknown seems, however, to Burthogge to require no proof. On the basis (1) of his view that external reality unquestionably exists, and (2) of his previous teaching that the object of knowledge has no independent existence, it follows inevitably that the external reality is unknown. If what is known is not external and if such external reality nevertheless exists, it follows that this reality must be unknown.[46]

The agreement of Burthogge's teaching with that of Kant is not complete. Marked as the likeness is between the two, Burthogge's epistemology seems to diverge from the Kantian at one important point. Along with his teaching that the mind independent of all external impression actively contributes part of its own object, Burthogge at the same time holds a sensationalistic doctrine. While agreeing with Kant in teaching that the notional factor is subjective in source, Burthogge seems to deny to the notion any *a priori* validity by holding, like Locke, that sense-impressions enter the mind directly, independent of *a priori* subjective conditions. "The senses," says Locke,

[43] A 252, 288; B 344.

[44] A 288, B 344.

[45] Sect. 13, Remark II. Cf. M. W. Calkins, *op. cit.*, p. 240, footnote.

[46] For Kant's arguments in defense of the view that external reality must be unknown, see *Critique*, A 128f, 244, 378.

"at first let in particular ideas, and furnish the yet empty cabinet."[47] And again: "Let us suppose the mind to be, as we say, white paper, void of all characters, without any ideas; how comes it to be furnished?....To this I answer in one word, from experience."[48] And there are passages in Burthogge which give the same sensationalistic account of the origin of our knowledge: "....the impressions of things without upon the Sensories," he says, "produce or occasion in them the Cogitations which we call Sentiments, as Colours, Sounds, Sapours &c. And Sentiments (again) impressing....the Minde and understanding, beget or occasion in it those higher Cogitations which we call Notions, Apprehensions of Reason or Ideas...."[49] This agreement of Burthogge's teaching with that of Locke, and the added fact that Burthogge's *Essay upon Reason,* dedicated[50] "To the Learned Mr. John Lock, Author of the Essay upon Humane Understanding," appeared four years after Locke's *Essay,* would suggest that Burthogge borrowed from Locke. A further consideration, however, proves the suspicion unwarranted. The *Organum* in which Burthogge's complete doctrine of knowledge is given, was published twelve years before Locke's *Essay.* Moreover, it will be noted that of Burthogge's two works the later shows less evidence of agreement with the Lockian teaching than the earlier. It is true that Burthogge insists in the *Essay*[51] as in the *Organum,*[52] that all knowledge comes through sense-experience. But the point of emphasis has been shifted in the later work. In the *Organum* Burthogge, like Locke, lays stress upon the fact that sense is the fundamental source of knowledge from which the notional is

[47] *Essay concerning Human Understanding,* Bk. I, Ch. II, par. 15.
[48] *Ibid.,* Bk. II, Ch. I, par. 2.
[49] *Organum,* Sect. 24.
[50] Preface, p. [1].
[51] Ch. III, Sect. 1, pp. 57, 59f, 62; Sect. 2, pp. 70, 74; Ch. IV, Sect. 1, p. 80, Sect. 2, p. 92; Ch. IV [VI], Sect. 2, p. 138.
[52] Sects. 9, 24, 26, 27, 32, 74², 92.

derived. In the *Essay,* on the other hand, Burthogge seems no longer chiefly concerned in showing that all knowledge begins with sense-experience but rather, like Kant,[53] in emphasizing the fact that since all knowledge comes through sense the object of knowledge must be phenomenal, not real.[54]

But granting that Burthogge seems to combine inconsistently a quasi-Kantian category doctrine with a Lockian sensationalism, the apparent inconsistency is not impossible of explanation. The explanation lies in two facts: in the first place, Burthogge does not include in his teaching an important part of the Kantian doctrine; and in the second place, his sensationalism is not of the thoroughgoing Lockian type. Burthogge never attributes, as Kant does, *a priori* validity to notions. While holding that notions are subjective and that they actively contribute to the make-up of the object, he never positively admits the Kantian teaching that these notions constitute the *a priori* condition under which alone sense-experience is possible. And, on the other hand, Burthogge does not hold with Locke, that sense-impressions enter the "empty cabinet" unaccompanied. Burthogge's teaching seems to be rather that, though sense-impressions are the beginning of knowledge, they never appear in the mind unaccompanied. Upon the occasion of sense-experience there are inevitably aroused in the mind certain notions. These notions are not derived from sense, but, lying dormant in the mind, are made operative upon the occasion of sense-experience. In other words, Burthogge holds neither the Kantian view that notions are the necessary condition for sense-experience, nor the Lockian view that they are merely an outgrowth from sense-experience. He seems to hold rather, that they are

[53] *Critique,* A 104.

[54] Cf. Burthogge on the advantage of knowing that the object of knowledge is phenomenal (*Essay,* Ch. III, Sect. 2, pp. 68-69) with Kant (*Critique,* 2d ed., Pref., p. xxi) and Locke (*Essay,* Bk. I, Ch. I, pars. 4-6).

the inevitable accompaniment of sense-experience, giving to it meaning.

But this reconciliation between Burthogge's sensationalism and his doctrine of subjective notions leaves still unexplained another apparent inconsistency in his teaching. The form of *apriorism* against which Burthogge argues is the same widespread "innate ideas" theory of the seventeenth century, later attacked by Locke.[55] In spite of this denial of original ideas independent of sensation ("Connatural and Ingrafted Notions; Principles designedly implanted in the Minde, to be a rule to it. . . ."[56]) Burthogge apparently admits, in the *Organum*, the validity of intuition in judgments of truth and falsity. This teaching seems to be directly opposed not only to his epistemological sensationalism, but also to his teaching that the criterion of truth is empirical. Burthogge indeed asserts both that the "form" or "notion" of truth must be known beforehand,[57] i. e., independent of sense-experience, in order that it may be applied as the test of truth when the object is presented sensuously, and (in apparent contradiction) that truth is *external* harmony, something in the object[58] which is perceived empirically only.

These two teachings about the criteria of truth certainly seem to be diametrically opposed, and yet it is possible once more to interpret Burthogge's meaning in such a way as to reconcile his intuitionism with his empiricism. If the account of Burthogge's epistemology as an intermediate form between the Kantian category doctrine and the Lockian sensationalism is correct, we need only apply this interpretation to his teaching about truth in order to explain the apparent inconsistency. In other words,

[55] *Essay concerning Human Understanding*, Bk. I.

[56] *Organum*, Sect. 73.

[57] *Ibid.*, Sects. 63, 64, 69, 74[a].

[58] *Ibid.*, Sects. 68, 69, 72, 74[a], 83, 84.

faculty of knowing and contemplating the order of nature and cooperating in thought with universal reason. Such an occupation was less necessary than any other; but then, no other was so beautiful. It was the spirit taking delight in itself after falling into line with the necessities of life; it was freedom, i. e., thought liberated from physical constraint and turning of itself toward its own object. With what artless joy and *abandon* the ancient Greeks used those wonderful instruments of thought: dialectic and syllogism, which they had just discovered! They are in no hurry to reach the goal; the path leading to it is so attractive! They are not so foolish as to fix a conclusion beforehand to their reasonings, but gladly content themselves with noble anticipations and glorious risks if logic is incapable of proving more. Moreover, are they not assured that reason, that divine power within the human soul, is itself the sovereign and pattern of the universe, and consequently that science and happiness are the natural reward of a methodically planned reason? Why should philosophy impose restraint upon itself? Its sovereign sway within its own domain is beyond dispute. Religion, which appeals to the exterior man only, does not suspect it, nor is science, born beneath its wing, hostile to it. Freely it continues its task which is none other than the full blossoming of reason, the embellishing both of universal nature—in which we find it living—and of our own nature, in which we bring it to birth.

Such was ancient philosophy; modern philosophy is altogether different. This latter does not find the ground free nor can it provide itself with its own law. While the ancient wisdom was crumbling away, religion was gaining hold on the souls of men, either satisfying or awakening moral needs almost unknown to the ancient Greeks. Henceforth man no longer contents himself with forming one spirit with nature and contemplating that supreme

thought on which the world is founded. He regards nature as corrupt, and would like to break the bonds that bind him thereto. His will is to know a supernatural world whose regenerating influence he receives during this lifetime. In it he deserves to live forever after death. The consciousness of his sin and wretchedness besets him; while in this state he is tortured by the desire for endless perfection and happiness. Life must of necessity be the means of proceeding from hell to heaven; the Supreme Being must be a Father who has pity on his creatures. Religion alone means to answer these needs which itself has called forth or nurtured. Concerning things above, religion has received illumination that transcends reason; it is in possession both of purifying pardon and of transforming grace. It gives this world over to reason—which forms part thereof—in order to reign alone in the next, man's true home, compared with which the present world is as nothing.

Here, then, we have philosophy removed from the invisible world, dispossessed of the supreme control of the human soul. Will it, at least, remain in possession of the visible world? This was the case during the whole of the Middle Ages, when, as religion itself acknowledged, the explanation of natural phenomena was sought for in Aristotle's *Physics*. The sixteenth century, however, witnessed the birth of a rival power with principles of its own and claiming that it alone could interpret nature, and this power was science. It is not the qualitative element in things, the object of metaphysics, said the scientist, that is able to explain phenomena: they are explained as being dependent on numbers, magnitudes and mathematical properties which are clear in themselves and have no need of verification by philosophers. What we have to do is to observe phenomena, try to discover inductively their more or less constant relations to one another, and finally to

reduce these relations or laws, which are still obscure and contingent, to mathematical formulas, disentangled of all sensible or metaphysical matter and thereby exclusive of all indetermination; by this means, man really acquires that mental representation of the universe and empire over things that is the supreme goal of his ambition on earth. Still uncertain of its independence in the days of Copernicus, Galileo, Kepler, Descartes and Newton, science, finding its material in observation and experimentation, as it found its form in mathematics, speedily became emancipated; nowadays it stands on its own feet. And whereas at first it limited its ambition to explaining astronomical or purely physical phenomena, and only in a spirit of audacity which it knew not how to justify, challenged the manifestations of life, it has gradually, by a process of continual advance, entered realms which it was forbidden to approach, and now we find no single element of reality that has any right to close the door upon it.

With these two powers, science and religion, modern philosophy came into contrast. At a time when the moral world is wholly occupied, when the power which is to seize upon the material world becomes conscious of its might, reason recovers possession of itself and claims its kingdom. In what position does it find itself when advancing this claim? During its beauteous and fertile youth, reason produces an amazing diversity of systems. This very profusion is now working against it, for truth must always be one and the same. Moreover, when examining itself, ever since the days of antiquity, reason has frequently wondered if the absolute it seeks is really accessible and if its ambition does not transcend its powers. And so it is, when feeble and distrustful of itself, that it undertakes to begin its work all over again. How much more difficult the task is now than it was in the past! No longer is freedom of thought an attribute of the human soul. Even in

such as consider themselves independent of religion, there exists the need of religion, imperiously demanding satisfaction. And none the less do those to whom science affords no satisfaction regard its findings as truths that brook no contradiction; these findings possess a type of certainty of which the ancient philosophers knew nothing. If philosophy would live, it must take account of these requirements. No longer can it quietly follow the lead of reason. Problems are set which it is compelled to meet. What is the destiny of man? What is duty and on what is it based? What is freedom? What is merit? Is the Architect of the universe likewise a Providence, assisting man and dealing with him according to his moral worth? Such questions as these, which men like Plato and Aristotle encountered only when they had to come to the end of their investigations, frequently leaving them unsolved, are now enjoined on the philosopher as essential questions which must be answered at all cost and with the utmost precision. The philosopher, too, cannot avoid inquiring what this mechanism consists of which science brings into evidence, and how far it extends. What is that experience? What are the mathematics to which we are indebted for certain truths and which, we are assured, form our only means of knowledge? When antiquity encountered such problems, it was in order to become aware of the power of reason which then had within itself the germs of science. Now, however, nature is self-sufficient. The scientist does not know whether there is reason in nature or not, and, for the philosopher, the data of science are a barrier-line sternly drawn by a foreign ruler who scorns to make known his right to do so.

That free philosophy, then, in which the sages of old took delight, is dead. To the moderns, philosophy has ceased to be a noble diversion, a kind of divine pastime; it is a task, a serious matter, the struggle of reason for its very existence. Disputing the claims of religion and sci-

ence, philosophy must give proof that it too has rights and a kingdom of its own, that it is vain for us to pretend to do without it, that it is as redoubtable to him who denies it as it is propitious to him who renders it justice, that it fears nothing from truth but rather feeds thereon and increases its power: in a word, that it lives and has power to continue alive.

Such, indeed, is the spectacle offered to us by modern philosophy. It struggles for a place between religion which commands and science which ascertains facts. At one time, examining the principles on which its opponents take their stand, it proves them ruinous unless supported by reason; at another time, it appropriates whatever is best in the doctrines and methods brought against it and turns into an instrument what seemed an obstacle; at another time it refutes and denies, and that to some purpose. Then, in self-defense, modern philosophy traces the frontiers of its kingdom: criticizing the powers of reason and fearing not to sacrifice largely in order to enjoy in safety what it retains. And now, by reason of this very criticism, thinking it has won autonomy once for all, it launches forth, and, from the depths of the infinite into which it plunges, assists at the creation of being. Here, in humbler mode, it describes and analyzes, adapting the method of physical science to the study of mental problems. In other things, it limits its ambition to classifying and organizing science. In the latter, it imagines human consciousness to be an original, special principle, as certain as any scientific or religious principle, and adequate for the foundation of the main truths which the intellectual and moral life takes for granted. In the former, it reveals and makes universal the most general principles of the sciences, in order to obtain such a view of the totality of things as is strictly in conformity with the data of experience. Thus philosophy becomes scientific with Bacon, Descartes and Leibniz, re-

ligious with Malebranche and Spinoza, descriptive with Locke, critical with Hume and Kant, moral with Kant and Fichte, transcendental with Schelling and Hegel, positive with Auguste Comte, psychological with Royer-Collard, Cousin and Maine de Biran, idealistic with Berkeley and Mill, both synthetical and experimental with Herbert Spencer. These various systems are not, as with the Greeks, the spontaneous fruits of a productive organism which is growing in every direction: each of them has for its object a more satisfactory solution of the difficulties that beset the mind of man, and arise either from religion or from science or from the relations between the two. Each of them is an attitude of reason brought face to face with its rivals: in the one case it rebels and struggles, in the other it brings the hostile powers into agreement or reconciliation with each other.

And so the history of modern philosophy is a drama of which reason is the center. The problem is to find out whether the ambition to understand, which man formerly regarded as his greatest quality, is condemned once for all, or whether human destiny henceforth consists in passive obedience to a master or in registering facts the meaning of which it is impossible to know. How can we remain aloof and indifferent when we see reason thus struggling for its very existence? How can we help gazing eagerly on the stage of life? If it is a noble spectacle to see a nation struggling for its independence, a conscience for the faith it holds, the disinherited for their means of livelihood, enthusiasts for their dreams, and passions for their satisfaction, how can it be uninteresting to see the human reason of antiquity spring into renewed life before the powers that imagined they had crushed it, collect its forces, organize attack and defense, retreat and advance in turn, drive against the enemy his own troops, and finally recreate for itself an empire wherein to reign once more in

power and glory? No, this is no idle sport; it is a real war with the souls of my fellow-beings as its battlefield, and with greater intensity than ever, in presence of this drama of moral history, there comes to my mind the poet's line: "I am a man, and nothing human is alien to me."

But is this sufficient, is modern philosophy nothing more to us than a spectacle to gaze upon? Shall we show only sympathy to the reason that insists on existing, whereas the conditions of its existence seem to have disappeared? It may suit some individuals to stand aloof from this warfare and take a curious interest in the fortunes of the fight. The human mind, however, even in these days, has not attained to this degree of detachment, and if we each one question ourselves, we find that, in this drama which we are interested in watching, the hero is another ourself; we see that we are actors as well as spectators.

Indeed, can we regard as now solved the problems which have stirred the minds of modern philosophers, and that in a sense condemnatory of philosophy? Does the human mind consider that religion or science, in so far as they claim to be adequate for man, have carried the day? Science has kept its promises. Armed with the twin weapons of observation and calculation, it brings beneath its sway every element of given reality, even such elements as appear least susceptible of being reduced to strict laws. The mind places full trust in it and abjures the right to dispute the principles on which it rests. But the more definite are the methods and results of science, the more evident it becomes that true being is beyond its scope. It decomposes and reduces, trying to find being in a simple immutable element. It thus reduces the thinking to the feeling being, the feeling to the living being, the latter to chemical substance which is supposed to consist of invisible and hypothetical atoms, themselves regarded as derivative beings

awaiting further reduction. The being after which science seeks eludes it continually; we cannot conceive of what that simple material element, to which alone objective existence must belong, is composed. Nor is this all. Speaking generally, scientific method consists in explaining the qualitative side of things by their quantitative side, the phenomena given in consciousness by the corresponding determinations of space. Space, however, considered as existing *per se*, is a thing incomprehensible; something, moreover, that science in no way claims to impose upon us. Space is inseparable from our perception of it, quantity is a quantification performed by the mind: thus, to reduce soul to matter is to reduce soul to soul itself, and science proves to be a vicious circle.

But that is of no consequence, we shall be told: science is the sum total of the knowledge it is given to us to acquire, and we must simply abandon the attempt to know that to which science cannot attain. This is all the scientist seeks, he discovers that the very thought of such problems as science is unable to solve gradually fades away from the mind.

Perhaps such a mental state, natural to one exclusively devoted to scientific investigation, might extend to all men, did the desire to know, of itself alone, fill the entire mind. But we possess in addition the power to act, to act from motives. Now, the whole of science, even if we supposed it to be complete, is incapable of supplying us with the faintest motive to action. It can tell us how, and in obedience to what motives, certain men have acted, it can ascertain that we have certain instincts or tendencies to act in some particular way; but nothing it can find will contain a reason for acting, a valid answer to the question: what advantage will it be? When I am told that the struggle for life is the fundamental law of nature, and that all our institutions, all our inventions—including those of

the intellect—and all our feelings, even those that appear most disinterested, are but effects of this law, I cannot find in such a theory any principle of action, since life for its own sake is worthless in my eyes; rather than force myself to efforts and tasks that have so vain an end in view, I would withdraw from the stage and feel inclined to cheat plans and expectations of so baffling a nature. The reason I reject pessimism and persist in my will to live is not because I am told that renunciation of life comes under the category of love of life, which love, consequently, remains the essential tendency, it is because I make an end or object for myself of that which I ascertain as fact, because I convert into morals that which is but science. Mankind has never lived by virtue of knowledge alone; were we seriously to resolve to obtain from nothing but science our reasons for acting, the effect would be gradually to slacken the springs of action and make man, after he had been reduced to a state of natural inertia, the mere sport of external influences.

Consequently, it is morally impossible for mankind not to look beyond the world as shown by science: man must have something else that will satisfy his need to know, and more especially his power to act. True, religion offers itself to meet the demand of human nature, without recourse to philosophy being necessary. And indeed, the feelings propagated by Christianity: love for the poor and lowly, respect for the human soul, the worth of moral intentions, the beauty of self-denial and confidence in the triumph of justice, are living and held in honor among men as much as ever they were. But if the Middle Ages, after appreciating Greek philosophy, were even then only willing to believe in order to understand, how much stronger is the refusal of modern generations, reared in the school of science, to adopt any dogma without sternly discussing its origin and value! And even were religion to demon-

strate what it asserts, viz., that its dogmas are supernatural revelations and that it holds promises of bliss, man would still not consider himself satisfied. For that which is only supernatural is alien to him and may crush, not convince him; while as for the happiness he is promised, he will not find it if his reason is coerced, and even if he did, he would be likely to repeat with the sages of old: better suffering in freedom than ease in slavery.

Thus, neither science alone, nor religion alone is capable of satisfying man. He wants to deal not only with astronomical and physical, physiological and psychic phenomena, but with himself as distinct from all these. He wants not only to know but also to act, to act in accordance with motives, and nothing external to himself, nothing given to him as a simple fact, can he regard as a true motive. He acts according to his idea of action only when he finds within himself the principle of his determination. And so, whether clearly conscious of it or not, he dwells in a world other than that of facts, whether natural or supernatural. Facts are but the externals of being: man would plunge into the heart of being itself. In the least of his conscious sensations, there are the confused idea of existence for itself and that of the power to act which characterize true being. That reflection on these inner depths of human nature is not found in all men, nor is indispensable to existence, is both evident and natural. Light sheds its beams, just the same, on the man who shows no curiosity as to its source. But the human mind, which reflects on everything that comes before it, cannot possibly refrain from inquiring what it is itself, when everything it studies depends on the being in which it participates. The ancients clearly saw that this exercise of reason was a noble and beautiful function, well deserving to occupy man's leisure hours: for the moderns, it is something inevitable, since both religion and science, which claimed to make philos-

ophy useless, are unable to satisfy the very needs they themselves call forth and keep alive.

Again, if the leaven of philosophy were to disappear from the human soul, one might well inquire whether scientific and religious activity would not itself be condemned. Why do we cultivate science, i. e., the disinterested knowledge of the nature of things, except for the reason that we find in it food for the spirit, something that adorns our very existence? Science, which prescribes no action of any kind, does not even invite me to cultivate science. To give myself up to it, I must find in it some pleasure worthy of being enjoyed; I must love and esteem the reason which it develops within myself, I must believe it worth while to become aware of the economy of the universe. What, too, will be the object of religion, if we are really nothing but passive instruments in the hands of an almighty force? Vainly does this force impose on us the most sublime actions. Unless we make our own the reasons of these actions by proving them to ourselves, unless we convert into free volition what at first was but an outer command, we gather no fruit from our obedience, we do not become religious at all. Religion has no grounds for existence unless it finds a man to whom to appeal, a man, i. e., a reason capable of understanding, appreciating and willing.

This struggle for existence, then, on the part of the reason, which constitutes modern philosophy, concerns us also, if we want the human ideal to be realized. Before us as before philosophers like Descartes, Spinoza, Leibniz and Kant, two paths open out: that of sense and that of spirit. It is materially permissible to take the former. In that case, there will be nothing for us but facts. History as the introduction and science as the conclusion represent the whole of the knowledge to which we can lay claim. But if we are not satisfied, in practical life, with the prin-

ciples of action that instinct, custom and science can give us, religion is there to impose commands on us in the name of an infallible and omnipotent will. We can make such a decision: if we do, the history of modern philosophy becomes relegated to the past, so far as we are concerned; it certainly retains the interest attaching to an account of anything human, but is not at all our own affair, we are watching the combat without having any voice as regards the issue.

We may also inquire what would become of mankind, if intellectual and moral life were limited to the culture of science or religion stripped of everything philosophical. Doubtless, we should have long to wait for any result. Man lives on a substratum of habits that may long survive their causes. Still, if science affords man no motive for action, and religion, of itself alone, imperfectly supplies this lack, how can we help dreading lest the exclusive sway of either the one or the other, or of both combined, gradually enfeeble the human will, and, in the end, deliver man up to pure instinct and blind force? It is action that creates human institutions, discoveries and civilizations, sciences and religions; and if one would act, one must believe oneself something. How can a man persist in willing, if he is convinced that will is an illusion, and that it is nature alone, with her mechanical forces, that produces our apparent power of initiative? Freedom is no physical phenomenon which outlives its scientific explanation. Explained by science, freedom receives its death-blow: it must disappear in time. It exists only in those who regard it as scientifically inexplicable. The idea we form of the history of philosophy thus depends on our will itself. If we cease to regard as realities both human action and the reason which is its essence, then the history of philosophy, like natural history, offers us nothing but facts to register and classify; but if we wish reason to be, to develop and

extend its empire, if we wish motives of action, thought and life to be retained by reflecting men, if we wish science itself and the moral feelings not to lose the credit we find them enjoying, then the history of philosophy, especially of modern philosophy, will be to us both a living problem and a glorious panorama; systems will no longer be abstractions, but rather clear, distinct voices whispering to the human soul; the clash of ideas will no longer be a simple relation between phenomena, but a division between ourselves and ourselves, and the historian will lend an ear both to the philosopher and to the man.

Is not this the path along which we should choose to travel?

EMILE BOUTROUX.

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LEONARDO DA VINCI.

(Born 1452. Died 1519.)

THE fourth centenary of Leonardo da Vinci has been celebrated in Italy; in England the date of the death of this strange and legendary figure of the latter half of the fifteenth century, who was "still climbing after knowledge infinite," has passed almost unnoticed. Always one of the world's greatest names—for no artist of the past lent himself so readily to apotheosis—his fame has grown with the revelation of his greatness as a man of science. Other sons of the Renaissance, such as Leon Battista Alberti, were gifted with comprehensive genius, but the quality of Leonardo's endowment dwarfs their record when we sum up his activities as painter, sculptor, architect, engineer, hydraulician, anatomist, mathematician, geologist, botanist, astronomer, and geographer.

Apart from his guesses and achievements in these provinces, there is something in his personal character "super-European and silent," as Nietzsche terms it, "the characteristic of one who has seen too wide a circle of things good and evil." He behaved in such a way as to arouse the wonder of his contemporaries. "He dressed with originality and distinction, bore himself impressively. Surrounded, so to speak, by censer-swinging acolytes, he acted the part of hierophant and modern Empedocles, and was not far from being a precursor of Paracelsus."[1] He was

[1] B. Berenson, *The Study and Criticism of Italian Art*, London, 1916, p. 19.

unconditioned, above the law, the divine artist, the worker of miracles. Yet he was a solitary in the midst of court life, in the changes and chances of his employment, and speaks of the necessity of the solitary life in no uncertain voice:

"If you are alone, you belong entirely to yourself; if you are accompanied even by one companion, you belong only half to yourself, or even less in proportion to the thoughtlessness of his conduct; and if you have more than one companion, you will fall more deeply into the same plight."[2]

We see how the strange and solitary power is impressed on his red chalk drawing in his old age of his

> "silent face,
> The index of a mind forever
> Voyaging through strange seas of thought alone."

For all his cryptic utterances and the reserve of his spirit, we must not suppose that he was in any respect a charlatan, a suspicion that clings to the name of Paracelsus. His notebooks bear witness to the intense and laborious concentration of his mind upon the problems of science, physics, or engineering he had set before himself, to his patient and manifold industry, the ordered continuity and range of his effort. His personal character, as shown in the glass of his notebooks rather than in the distorting mirror of Vasari's famous *Life*, reveals an authentic greatness.

"I wish," he says, "to work miracles; I may have fewer possessions than other men who are more tranquil and those who wish to grow rich in a day."

"As a well-spent day brings happy sleep, so life well used brings happy death."

"Our body is subject to heaven, and heaven is subject to the spirit."

[2] E. McCurdy, *Leonardo da Vinci's Notebooks*, London, 1907, p. 166.

"Where there is most power of feeling, there of martyrs is the greatest martyr."

"Intellectual passion drives out sensuality."

"To the ambitious, whom neither the boon of life nor the beauty of the world suffices to content, it comes as a penance that life with them is squandered, and that they possess neither the benefits nor the beauty of the world."

These sublimations of Leonardo's experience are expressed with a concision which renders him, like Blake, the master of significant language.

Leonardo's life is a paradox. He recommends for the artist a life spent in the seclusion of the studio; his own was spent in courts; a wanderer, from place to place—Florence, Milan, Rome, finally Amboise in France. The most laborious of men, he has left little realized and achieved work in building and the arts behind him. None of his monumental projects of construction or town-planning seem to have been carried out, most of his paintings and sculptures were never executed, others were left half finished.

He has survived his masterpieces. Modern research has shown him to have been, not the capricious and inconstant artist whose performance was always less than his promise, but the most learned of painters, studying with the intentness of a scientist the medium in which he worked, the structure of the human body, plants, trees, and rocks, in order that he should know their essence and inner reality.

His habit of scientific investigation[3] in the end drew him aside from the practice of his art; he was rapt away by the Virgilian passion *rerum cognoscere causas*. It was impossible, Isabella d'Este found, to get a picture out of him. She had applied to a friar of the Carmelite Order

[3] According to Sabba da Castiglione, "when he ought to have worked at painting, in which he would without doubt have proved a new Apelles, he gave himself up entirely to geometry, architecture, and anatomy." *Ricordi*, Venice, 1565, 115, v.

whom she knew, to know what manner of life the master was leading, and the answer was returned that he was "entirely wrapped up in geometry, and has no patience for painting." The whole world of knowledge was his province. In reading his notebooks there is at first a feeling of disappointment at the meagerness of the scientific result, but this is counterbalanced by the realization that he is the first of the moderns in his belief in experimental methods, his distrust for mere authority in science as in the arts he practised. "Whoever in discussion," he writes, "adduces authority, uses not intellect, but rather memory."[4] He has been loosely said to have been the forerunner of Bacon, Watt, Newton and Harvey, but it cannot be maintained that he anticipated their discoveries in any definite sense. Though he set down in unusually large letters "the sun does not move,"[5] and surmised that the earth was a star "much like the moon," and knew that blood moved,[6] and so forth, his actual achievements were in the invention of certain ingenious devices, such as the diving-bell and the lifebelt, and in the employment of a definitely scientific method, as in his discovery of the significance of fossils found in the mountain ridges of Lombardy as showing the waters at one time covered the earth.

"If you should say that the shells which are visible at the present time within the borders of Italy, far away from the sea at great heights, are due to the Flood having deposited them there, I reply that, granting this Flood to have risen seven cubits above the highest mountain....those shells which always inhabit near the shores of the sea

[4] "Those who study only the authorities and not the works of nature are in art the grandsons and not the sons of nature, which is the supreme guide of good authorities." *Codice Atlantico*, 141, v. b.

[5] J. P. Richter, *Scritti letterari di Leonardo da Vinci*, London, 1883, Vol. II, p. 152.

[6] "The heart is a muscle of great strength, much stronger than the other muscles....The blood which returns when the heart opens again is not the same as that which closes the valves." Richter, *op. cit.*, Vol. II, p. 132.

ought to be found lying on the mountain side, and not at so short a distance above their bases, and all at the same level, layer upon layer. Should you say that the nature of these shells is to keep near the edge of the sea, and that as the sea rose in height the shells left their former place and followed the rising waters to their highest level: —to this I reply that the cockle is incapable of more rapid movement than a snail out of water, or is even somewhat slower, since it does not swim, but makes a furrow in the sand, and supporting itself by means of the sides of this furrow it will travel between three and four braccia a day; and therefore with such a motion as this it could not have traveled from the Adriatic Sea as far as Monferrato in Lombardy, a distance of two hundred and fifty miles, in forty days. . . .

"If you should say that the shells were empty and dead when carried by the waves, I reply that where the dead ones went the living were not far distant, and on these mountains are found all living ones, for they are known by the shells being in pairs, and by their being in a row without any dead. . . . where the valleys have never been covered by the salt waters of the sea, there the shells are never found. . . . . Such things are far more ancient than letters, it is not to be wondered at if in our days there exists no record of how the aforesaid seas extended over so many countries. . . . . But sufficient for us is the testimony of things produced in the salt waters, and now found again in the high mountains far from the seas."[7]

His science was, in the main, applied science, as might be expected from the realistic cast of his mind. He seems to have seen every problem as, in a sense, a problem of engineering. As Mr. Havelock Ellis writes: "All nature was a dynamic process of forces beautifully effecting work,

[7] Quoted and translated in Mr. E. McCurdy's invaluable *Leonardo da Vinci's Notebooks*, London, 1907, pp. 106-109.

ness of the human corpse, and was ready to punish as sacrilege the use of the scalpel.[13]

What was his attitude to the Church which would have stayed his hand? He may have been clearly disdainful of the established religion, as he was clearly disdainful of the frailties and practices of the priesthood; or again he may have regarded the faith of his age "with imaginative acquiescence, if no more."[14] In his will, made when his end was near, he provided for masses to be said and candles to be offered in three different churches of Amboise; while Vasari, in the first edition of the *Lives* (which he afterward suppressed), says that Leonardo "was of so heretical a cast of mind, that he conformed to no religion whatever, accounting it, perchance, much better to be a philosopher than a Christian." His notebooks, private and informal records as they are, are silent, but it may be surmised that his choice of reason rather than authority would have led him away from the levels of revealed religion. In the subjects that he pursued he had no need of that hypothesis. He sings hymns to Law and Causation:

"Nature never breaks her own law.

"O marvelous necessity, thou with supreme reason constrainest all efforts to be the direct result of their causes, and by a supreme and irrevocable law every natural action obeys thee by the shortest possible process.

"Who would believe that so small a space could contain the images of all the universe? O mighty process, what talent can avail to penetrate a nature such as thine? What tongue will it be that can unfold so great a wonder? Verily none. This it is that guides the human discourse to the considering of divine things."[15]

Leonardo, who sums up war as a "bestial frenzy" (in

[13] McCurdy, *op. cit.*, p. 6.

[14] *Encyclopædia Britannica*, art. "Leonardo."

[15] *Leonardo da Vinci's Notebooks*, p. 117.

the descriptive passage entitled "The Way to Represent a Battle"), was the inventor of numerous engines of war, steam guns and breech-loading arms with screw breech-block, and in the draft of a letter in which he offers his services as architect and military engineer to Ludovico Sforza, Duke of Milan, he claims that he can "construct bridges that are very light and strong and very portable, with which to pursue and defeat the enemy, and others more solid, which resist fire or assault," also "a kind of cannon which is light and easy of transport, with which to hurl small stones like hail," "catapults, mangonels, *trabocchi*, and other instruments of admirable efficacy not in general use," and "armored wagons carrying artillery which shall break through the most serried ranks of the enemy, and so open a safe passage for the infantry";[16] he can also construct "subterranean passages either straight or winding, passing if necessary underneath trenches or a river."[17]

As far as the evidence of Leonardo's manuscripts can substantiate the claims put forward, they have been found to have been correct; and Dr. Müller-Walde,[18] in that portion of his work dealing with Leonardo as a military engineer, has shown that Leonardo did in fact study the construction and use of the engines of warfare mentioned in the first seven clauses of the letter.

In the arts of peace, his schemes and sketches for canalization and the lay-out of towns are no less remarkable. According to specialists' opinions, Benedetto Castelli, who is considered to be the actual originator of the Lombardy canal system, appears to have studied Leonardo's schemes, in which practical standards for hydraulic engineering are

[16] Tanks?

[17] *Codice Atlantico*, 1 391, v.

[18] *Leonardo da Vinci: Lebensskizze und Forschungen*, Munich, 1889-90, pp. 139-232.

already worked out.[19] He wished to lay out cleaner and healthier cities, so that the people would not need to live "packed together like goats, and pollute the air for one another," and proposed to Il Moro to build ten cities, each with 5000 houses and accomodating 30,000 inhabitants. These cities are to be seated on rivers regulated by locks; the streets are to be as wide as the height of the houses, and laid out with wide squares and market-places. Moreover, he provides two kinds of streets on different levels, the higher and spotless walks for foot passengers, and the lower for traffic, which can be cleaned by flushing from locked rivers.[20] In his notebooks are found a wealth of designs, exhausting every possible combination of circular and polygonal ground-plans for domed public buildings and churches. As he himself states, it was his intention to write a treatise on the theory of cupola construction. His devices and designs for hydraulic work, and for war-like machines, were, for the most part, within the limits of possible construction in his day. It is otherwise with the problem that occupied so much of his time, that of flight.

He had for many years watched the flight of birds, and made himself, thanks to an amazingly keen power of fixing rapid movement, familiar with every characteristic of wing action. The subject gives its name to a treatise which exists in a more or less complete form—*Il Codice sul volo degli uccelli*, and is also treated in the *Codice Atlantico* and other of Leonardo's manuscripts. The conviction grew on him that men might raise themselves above the earth on wings, for:

"A bird is an instrument working according to mathematical law, which instrument it is within the capacity of man to reproduce, with all its movements, but not with a

[19] M. Baratta, *Leonardo da Vinci, ed i problemi della Terra*, Turin, 1903.

[20] O. Sirén, *Leonardo da Vinci*, Yale University Press, 1916, p. 123.

corresponding degree of strength, though it is deficient only in the power of maintaining equilibrium. We may therefore say that such an instrument constructed by man is lacking in nothing except the life of the bird, and this life must needs be supplied from that of man."[21]

Flight is a natural phenomenon, and consequently its laws are to be deduced by observation of nature. Yet Leonardo doubted the adequacy of strength of the human agent to accomplish more than short flights, and sought to supplement it by a screw-propeller. He has a drawing of a large screw constructed to revolve round a vertical axis. "The notes at the side and below the drawing tell of the materials and dimensions, and reveal also the purpose which it was intended to serve. M. Govi, who first called attention to the significance of these passages, speaks of them as proving not only that Leonardo invented the screw-propeller, but that he had considered small paper models for this purpose, which were set in motion by fine bent steel wires."[22]

He must have, at one moment, at any rate, felt sure of success, when he wrote triumphantly that "the huge bird will take his first flight high aloft on the ridge of his great Ceceri—the mountain between Majano and Fiesole—he will fill the universe with wonder and all writings with his fame." The experimental flight must have failed, but from his own day Leonardo has not been judged by his achievement, for, in the words of his earliest biographer, "his spirit was never at rest, his mind was ever devising new things."

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[21] *Codice Atlantico*, 161, R. a.

[22] *Nineteenth Century*, July, 1910.

CRITICISMS AND DISCUSSIONS.

IMMORTALITY AND MONADISTIC IDEALISM.

The problem of immortality is normally central in a cosmology which conceives of the universe as a spiritual system. Is the spiritual system fundamentally and inevitably personal: a person or a society of persons? Are the careers of finite individuals but passing episodes in a timeless system, or its eternal constituents? In all these problems the issue of immortality is squarely raised. Failure to meet this issue squarely has involved many an idealistic theory in ambiguity and confusion.

Hegel's apparent indifference to the question of immortality, a source of surprise to many a student, is, in the view of Dr. McTaggart,[1] a defect in his philosophy. Dr. McTaggart, himself building on Hegelian foundations, attempts to improve on his master by giving the problem of immortality central place in cosmological discussion. In his *Studies in Hegelian Cosmology* he undertakes a metaphysical demonstration of the eternity of finite selves, and in *Some Dogmas of Religion*[2] he examines three of the more usual arguments urged against immortality and also champions human preexistence. The arguments which he advances in support of what he considers human immortality, the vigor with which he advocates the doctrine of the plurality of lives, the atheism to which he is finally led, are all very significant aspects of contemporary idealistic thought. An endeavor will be made in this paper to formulate Dr. McTaggart's theory of immortality and preexistence, and, in the

[1] *Studies in Hegelian Cosmology*, Cambridge University Press, 1901, pp. 5ff. Cf. Professor Baillie's criticism of Dr. McTaggart's interpretation of Hegel's attitude toward immortality, *Hibbert Journal*, Vol. I, No. 2, pp. 379f.

[2] London, Edward Arnold, 1906. Chapters III and IV of this work have been reprinted under the title, *Human Immortality and Pre-Existence*, New York, 1915.

light of this theory, to estimate his monadistic[3] interpretation and development of idealism.

I.

From the point of view of materialistic monism, human spirit is merely one of the ways in which matter operates when it is in the special form of a human body. So regarded, of course, the immortality of the self would be no more credible than the immortality of digestion. But the independent existence of matter, Dr. McTaggart argues in familiar Berkeleian terms, is a perfectly gratuitous and superfluous hypothesis. Science is by no means committed to a materialistic metaphysic. The "laws of nature" may quite as well be conceived as the laws according to which human sensations are related.

We are therefore not bound to regard the self as a mere activity of the body. Still, "granted that my body could not exist except for knowledge, it may be that the knowledge of my body, by myself or other selves, is a necessary condition of the existence of my self."[4] Dr. McTaggart parries the objection to immortality implied in this second supposition as follows. Sensations do seem to involve some corresponding bodily modification; but this proves at the most that *some* body is necessary to my self and that *"while the self has a body,* that body is essentially connected with the self's mental life."[5] At the death of this my body my self may conceivably transfer its manifestations to another body, either instantaneously or after "a state of suspended animation,"[6] analogous perhaps to dreamless sleep.

Yet, after all, what reason do I have for believing that the self persists while all objects in nature change and pass away? Were the self a mere combination, Dr. McTaggart rejoins, it would be transitory; but, while resembling a combination in that it cannot exist without its parts, it is unlike a combination in that its parts cannot exist without it. It is a complex which cannot disintegrate; it can perish only through annihilation, and we are not justified in contemplating such an eventuality.

In thus meeting the more obvious and usual arguments urged against immortality, Dr. McTaggart has no illusion that he has

[3] The phrase "monadistic idealism," I believe, is Professor Pringle-Pattison's. Cf. *Hibbert Journal,* Vol. V, No. 1, p. 197.

[4] *Some Dogmas of Religion,* p. 103.

[5] *Ibid.,* p. 105.

[6] *Ibid.,* p. 104.

reached positive certainty on the subject. Doubts beset us, and we look for more conclusive assurance. Some seek this assurance in "psychical research." While our author is not prepared to scoff at the ghost-seers, he expects no real proof of immortality from even the most authentic case of apparition. For a man might conceivably, before his death, initiate a chain of circumstances which would cause his apparition to be seen when he himself was really no more. Conclusive proof of immortality can come, if at all, only from metaphysics. If the general nature of reality involved the existence of finite selves, if the existence of finite selves, and of each finite self, were eternally necessary, the recognition of these truths would really assure us of immortality.

Such a metaphysical demonstration of human immortality is undertaken in *Studies in Hegelian Cosmology*. All reality is spirit, and "it is the eternal nature of spirit to be differentiated into finite spirits."[7] Can we, in addition, maintain that each finite spirit is eternal—or is each differentiation a step, itself transitory, in an eternal series of differentiations? Moreover, granted the first alternative, is man such a finite spirit? On the answers to these two questions hangs the whole issue of immortality.

Taking the last point first: Are our selves among the fundamental differentiations of spirit? Reality, we learn from Hegel, is characterized by a certain unity of individuals: a unity which is wholly in each of the individuals (else they would lack the requisite reality); yet is not wholly present in each individual separately (else the unity of the individuals would itself be destroyed); nor is it present in the mere assemblage of them (else it would have nothing to do with them as individuals); nor again is it present only in the mutual determination of the individuals (for that would imply that the individuals have meaning of their own apart from the unity). It must be a unity which is wholly in each of the individuals and is the bond which unites them. Unless we adopt this view we are forced to choose between undifferentiated unity (itself meaningless and making experience meaningless) and a plurality of isolated individuals (the inadequate view of the categories of Essence).

"The self answers to the description of the fundamental differentiations of the Absolute. Nothing else which we know or can imagine does so."[8] A self is finite. It is not the only reality in the universe, yet you cannot draw the line separating it from the rest

[7] *Studies in Hegelian Cosmology*, p. 7.
[8] *Ibid.*, p. 26.

of the universe. This paradoxical nature of the self is explained only if we regard it as one of the fundamental differentiations of Reality. These differentiations involve the same paradox. Everything is contained in each individual differentiation, yet nothing is contained in each differentiation in such a way as not to be also ouside it. "The Absolute must be differentiated into persons, because no other differentiations have vitality to stand against a perfect unity, and because a unity which was undifferentiated cannot exist."[9]

Passing now to the second question: Are our selves eternal? Granted that selves are fundamental differentiations of the Absolute, may it not be that the Absolute is "differentiated by means of an unending succession of individuals, each of whom has only a limited existence in time?"[10] But how is it possible for the selves to perish? The individuals are what they are because of the unity which they embody: each of them is a characteristic embodiment of the nature of the unity. Suppose one of them were to perish, another must take its place. If that other were the same in nature, wherein would it be a different individual? And if it were a really new individual, of a different nature, we should be forced into an absurdity. For, unless we abandon the pure Hegelian view of the absolutely reciprocal relation of the unity and its differentiations, and hold with Lotze the view that the Absolute is something more and deeper than the unity of its differentiations, we are compelled to recognize that a breach in the continuity of the fundamental differentiations would be a breach in the continuity of the Absolute—an unthinkable situation. Breach in continuity is admissible only if we conceive reality as "consisting of moments, of which one may change without affecting the other"[11]—a characteristic of the categories of Essence, especially of the category of Matter and Form, which is transcended in the advance to the categories of the Notion.

Our selves are thus immortal. This conclusion, according to Dr. McTaggart, implies not only the continued existence of the self after death, but its existence before birth. An argument which disproved preexistence would jeopardize immortality. "If the universe got on without me a hundred years ago, what reason could be given for denying that it might get on without me a hundred years hence?"[12] Why is it, then, that the typical Western mind has

[9] *Ibid.*, p. 17.

[10] *Ibid.*, p. 27.

[11] *Ibid.*, p. 32.

[12] *Some Dogmas of Religion*, p. 114.

regarded the belief in preexistence as "strange and improbable"?[13] Chiefly because we have no memory of any previous existence of ours. But, according to Dr. McTaggart, personal identity is not a matter of memory; it is an identity of substance. If at my death a self with the same attributes should come into being, the continuity of the attributes would be sufficient to preserve personal identity "not because it would be sufficient if the substance changed, but because it proves that the substance remains unchanged."[14] What we have is not the annihilation of one self and the creation of another, but the continuity of the same self through experiences of so serious a character as death and rebirth.

The doctrine of the plurality of lives should appear reasonable to any believer in immortality. An endless, deathless existence in the future would bear so slight a resemblance to our present life as scarcely to deserve being regarded as its continuation. The adoption of the hypothesis of preexistence, moreover, enables us to explain in a more satisfactory way than is otherwise possible, certain puzzling features of our present life. In the same environment different tendencies and qualities which we ambiguously call innate manifest themselves in different men. These tendencies and qualities are often of the sort which are due in the lives of other men to the condensed results of experience. On the theory of preexistence these tendencies and qualities are naturally explained as being indeed the condensed result of experiences in past lives. This explanation is more satisfactory than the explanation in terms of heredity. Again, the usual explanation of the sudden growth of intimacy in certain personal relations, as due to the capriciousness of sexual desire, is inadequate, since the puzzling sudden intimacy is to be found in friendships which have no connection with sexual desire. "On the theory of preexistence such relations would naturally be explained by the friendships of past lives."[15]

Now, to be sure, unless we had reason to believe that the interests of spirit are so predominant as to find in the long run

[13] *Studies in Hegelian Cosmology*, pp. 47ff. Cf. Lotze, *Metaphysic*, Section 245 (English translation, 2d ed., Oxford, 1887, Vol. II, p. 182). Dr. McTaggart attributes the characteristic Western indifference or hostility to this doctrine to the attitude of the Christian Church which has championed immortality and ignored preexistence, although, in his belief, the former involves the latter, and although there is apparently nothing in preexistence incompatible with fundamental Christian dogma. Cf. also *Some Dogmas in Religion*, pp. 112ff.

[14] *Studies in Hegelian Cosmology*, p. 51.

[15] *Some Dogmas of Religion*, p. 121.

satisfaction, it would be impossible to see how a love constituting the chief value and meaning of a person's life could have its way after death: how two could love again unless chance brought them once more together, or how a love denied fruition could remain unextinguished through eons of separation and new activities. (Though, to be sure, this embarrassment of love would seem to be the case whether we believed in preexistence or in the more usual conception of immortality.) Dr. McTaggart himself insists that the significance of love for spirit is very great, indeed that love is the finality and the perfect manifestation of the Absolute.[16] He is therefore inclined to believe that love is not the effect of proximity in personal relations, but its cause.

From this way of viewing the universe *sub specie amati*[17] Reality is seen as essentially spiritual; it manifests itself as eternal selves. The Absolute is a system of selves-in-relation. Now, then, the question arises, If finite selves are eternal, is the eternal Absolute a self? It is a unity of persons, Dr. McTaggart answers, but a unity or community of persons need not itself be personal. To be sure, the Hegelian Dialectic does not explicitly deny personality to the Absolute. That the Absolute may be a self remains possible under certain conditions, some of which Lotze attempts to point out in his *Microcosmus*.[18] Lotze regards the opposition of the ego to a non-ego, not as essential, but rather as a limitation, to personality. In the being of the Infinite we do not find this limitation;

[16] *Studies in Hegelian Cosmology*, p. 285: "The Absolute can only be perfectly manifested in a state of consciousness which complies with three conditions. It must have an absolute balance between the individual for whom all reality exists, and the reality which is for it—neither being subordinated to the other, and the harmony being ultimate. It must be able to establish such a unity between the self and the not-self, that the latter loses all appearance of contingency and alienation. And, finally, in it the separate and unique nature of each individual must be found in its connections with other individuals. We have found that knowledge and volition comply with none of these conditions. There remains only one other alternative at present known to us—love. I have tried to show that in this case all three conditions are fulfilled." The love of which Dr. McTaggart speaks is not "love of Truth, or Virtue, or Beauty, or anything else whose name can be found in a dictionary"; nor sexual desire; nor love of God, for God is not a personal unity; nor yet "benevolence, even in its most impassioned form" or widest extent, for we cannot love "an indefinitely extended Post Office Directory." He means rather "passionate, all-absorbing, all-consuming love,. . . .the love for which no cause can be given, and which is not determined by any outer relation, of which we can only say that two people belong to each other—the love of the *Vita Nuova* and of *In Memoriam*." (*Op. cit.*, pp. 260, 289, 290, 291.) So Dante, in the last line of the *Paradiso*: "L'Amor che move il sole e l'altre stelle."

[17] *Studies in Hegelian Cosmology*, p. 280.

[18] Book IX, Chapter IV (English translation, Edinburgh, 4th ed., Vol. II, pp. 659ff, especially pp. 678ff). Cf. *Studies in Hegelian Cosmology*, pp. 64ff.

nature of the former. My self's successor will be just what I would have been in his place; in short, he will be myself.

Continuity of consciousness, and the consciousness of continuity, are thus renounced. But can one dispense so readily with the factor of memory? As Bradley puts it, "The man in the past or in the future who knows nothing about me, whatever else he is, after all will not be myself....That what we have done in this life may cause our future love might be true, and yet, if nothing is remembered, individual continuance might to us then mean nothing."[28] Dr. McTaggart would say that, while the second self will not feel that it is the same as the first, it will nevertheless be the same. One might well retort that, since the second self will not feel that it is the same as the first, it might as well not be the same.

Theists, believing that each man lives his one life on earth and is thereafter immortal, have been confronted with the difficulty of contemplating the immense assembly of spirits that would thus be accumulated through the ages. William James, while he urges us to be forbearing and democratically tolerant with the endless throng of fellow-immortals, realizes the mental enormity of the task. "The very heavens themselves, and the cosmic times and spaces, would stand aghast....at the notion of preserving eternally such an ever-swelling plethora and glut of it."[29]

On Dr. McTaggart's theory we are perhaps spared this hardship. Indeed, if selves are the fundamental differentiations of the Absolute, if their interrelated activities and loves constitute the Absolute system itself, how can we admit an increase in their number? An increase in the number of selves would involve an increase of the universe. The entire position of Dr. McTaggart would be menaced by the possibility of one real self's *beginning* its career in time. We thus seem compelled to accept the doctrine that the number of selves-in-relation constituting the universe is constant. The eternal existence of human individuals on earth, however, can scarcely be admitted; we are, moreover, assured that their number has been on the increase for some time. Are we to be asked, then, to conclude that multitudes of us have drunk the waters of forgetfulness in non-terrestrial regions before being reborn here on earth, and that this immigration of selves on a large scale is going on all the time? And is one to presume also that the self-in-transit is in a state of "suspended animation," and that

[28] *Essays in Truth and Reality*, Oxford, 1914, pp. 455, 457.

[29] *Human Immortality*, 1898, p. 36.

the unsatisfied love-quests of certain souls on earth and their longings for they-know-not-whom are to be explained as due to the failure of certain other loving souls to follow them from one bodily field of operations to another? This difficulty is expressed in the space-time language of every-day speech, but stating the point in Dr. McTaggart's own language of mild immaterialism would not remove the difficulty.

We are involved in further embarrassments. According to the theory before us, the love of two people is "the expression of the ultimate fact that each of them is more closely connected with the other than he is with people in general."[30] The existences of two such people are essentially bound up; they are "bound up with one another, not for one life only, but for ever."[31] Now, it is presumably taken for granted by Dr. McTaggart that a self's character does not admit of its being involved in such intimate communion with more than one person. Otherwise we should have to conceive the possibility of a future Jonathan spurning his David, of a Tennyson finding Hallam tedious. Assume that Dante's communion with Beatrice lacks the eternal character: what is in our way of supposing that Beatrice's lover might not be, in a succession of life-spans, the lover of Laura and of Heloise, and the places of these in the lives of subsequent Petrarchs and Abelards be taken by the Donna of the *Vita Nuova*? Moreover, a Tennyson to whom *In Memoriam* is but something to read, a Dante to whom Beatrice is no more than she is to us—these were odd successors of their former selves!

Yet, grant the undying fire of the kind of love that is glorified in the *Divine Comedy*, grant Hallam's permanent appeal, it may yet be retorted that these are, after all, quite exceptional. Are we, then, to think that the usual interrelations of selves involve a plurality of loves in a plurality of lives? Perhaps this view is not altogether outside Dr. McTaggart's horizon. Tastes change; as he remarks in a somewhat different connection, "a Viking or a Maori warrior might well find that the prospect of an immortality without fighting made the universe intolerable."[32] But in the course of time his demands may change. And so may his love. One of the last merits which our author finds in the plurality of lives is that it affords an opportunity for an eternal variety of self-activity. "We cannot spend our youth both in the study and in the saddle. . . . We cannot

[30] *Some Dogmas of Religion*, p. 136.

[31] *Ibid.*

[32] *Ibid.*, p. 52.

learn the lessons alike of Galahad and of Tristram and of Caradoc. And yet they are all so good to learn. Would it not be worth much to be able to hope that what we missed in one life might come to us in another?"[33] It is perhaps not absurd to suppose that a self, careering in turn through the life-experiences of a Tristram, a Galahad, a Caradoc, will not keep on realizing his life's meaning and value in the same Iseult—unless indeed the nature of the latter exemplified love's perennial adaptability.

Dr. McTaggart is quite willing to admit that the love of two people for each other "would not involve their meeting in every life, any more than it would involve their meeting every day of each life. Love can survive occasional absences, and is often even stronger for them. And....the universe is on a large scale, which might require long absences."[34] But even on this supposition the hardship remains. Granting the likelihood of periodic resumption of the "passionate, all-absorbing, all-consuming love"[35] uniting two selves, what of the lifelong intervals of lovelessness? On Dr. McTaggart's estimate of the significance of love for self, this embarrassment appears very serious.

These perplexities involved in the view of the world *sub specie amati* only suggest the real difficulties in Dr. McTaggart's monadistic idealism. Perhaps the fundamental source of them all is to be found in his determination to equate reality with selfhood, and in his conception of selfhood. The cosmic process is described by him as consisting entirely of the interrelated activities of selves. This type of idealism is involved in an ambiguous account of the resistantly impersonal nature-medium in which selves seem to operate, and in a correspondingly ambiguous account of selfhood and personal identity.

Following in Berkeleian paths, Dr. McTaggart proves to his own satisfaction that "matter is only an appearance to the mind which observes it."[36] This view, in the way in which it is presented, is inadequate, not in that it is entirely false, but in that it is incomplete. It is only half a view. The statement that matter cannot exist independently of spirit or, to be more precise in this particular connection, independently of selfhood, is true only in so far as it is completed by its corollary converse. If matter cannot

[33] *Ibid.*, p. 138.

[34] *Ibid.*, p. 136.

[35] *Studies in Hegelian Cosmology*, p. 260.

[36] *Some Dogmas of Religion*, p. 83; cf. pp. 79ff.

exist independently of selves, it is because it is not a self-subsistent reality but one fundamental factor in the cosmic process of experience, which it does not exhaust, but which "selfhood" likewise does not exhaust.

To be consistent, Dr. McTaggart should have followed his negative answer to the question, Is my self an activity of my body? by a somewhat different answer than the one he gives to the question, Is my present body an essential condition of the existence of my self?[37] Had the latter question read: "Is my present body an essential condition of the existence of my present self?" it would be difficult to see the possibility of an intelligent negative answer. But Dr. McTaggart, viewing the continual change of bodies, views the self as continuously identical. He can conceive of one self as the tenant of several bodies in succession; but it must be the same tenant notwithstanding. Now we may ask: Is not the self inevitably a tenant of some sort? That is to say, is not an impersonal material medium or "body-appearance" of some sort as indispensable to its selfhood as is intercourse with other selves? It is surely as indispensable to the only kind of selfhood of which we have any knowledge.

Dr. McTaggart does not exactly evade the issue, but he does not meet it squarely. He recognizes that "no self can be conceived as conscious unless it has sufficient data for its mental activity."[38] But, he argues, "it does not follow, because a self which has a body cannot get its data except in connection with that body, that it would be impossible for a self without a body to get data in some other way."[39] That is to say, it does not follow, because a conscious self requires sufficient data for its mental activity, that a non-conscious self need be similarly limited. This may be incontestable; but what is the content or the nature of the "non-conscious self" so conceived? Are the fundamental differentiations of the Absolute, in Dr. McTaggart's view, "conscious" or "non-conscious," in the above meaning of these two terms? Dr. McTaggart concedes that "*while the self has a body*, that body is essentially connected with the self's mental life."[40] This concession is misleading and insufficient. Working for the time being on the theory that the fundamental differentiations of the Absolute are selves, we are bound to say: If mental life is not essential to selfhood, it matters com-

[37] *Ibid.*, pp. 79ff, 103ff.

[38] *Ibid.*, p. 105.

[39] *Ibid.*

[40] *Ibid.*

paratively little for our purposes whether a body be essentially connected with that mental life; but, if mental life is indeed essential to selfhood, then the phrase "*while* the self has a body" is unwarranted.

The important question, after all, is whether a "mental life" (in the above sense) is a *sine qua non* of selfhood. In a universe described as fundamentally a society of selves, what is the role and the content of the self "in a state of suspended animation in the interval between its possession of its two bodies"?[41] How is it related to selves-with-bodies and to other selves "in a state of suspended animation"? Moreover, how is the reality of these two bodies to be conceived? If we cannot say, in Dr. McTaggart's phrase, that the self in suspended animation "has" either of these two bodies, how are they at all real, if body, or matter, as we have been told already, is "only an appearance to the mind which observes it"?[42] To what mind are two such bodies present as appearance? Perhaps to a mind regarding them as the no-more and the not-yet body of the self in suspended animation? But, in that case, we must admit that selves-with-bodies may be in relation with selves in suspended animation. On this alternative Dr. McTaggart should give more countenance to "psychical research" and kindred phenomena than he appears inclined to do. Indeed, it is not easy to see precisely what is intended in the theory before us by a self "in a state of suspended animation."

The philosophy of Dr. McTaggart is an attempted revision of Hegelian idealism in personalistic terms; yet in its very conception of personality is fails to utilize one of the chief gains of nineteenth-century idealism, and, instead of advancing beyond Hegel, it retreats to the pre-Kantian substantialist views of the self. To Dr. McTaggart the self, whose identity he traces and whose immortality and preexistence he champions, is not fundamentally a transcendental unity of apperception or any other kind of conscious unity. The identity is an identity of substance, the preexistence and immortality are the preexistence and immortality of a continuous self-identical entity. The hand is the hand of Hegel, but the voice is the voice of "rational psychology" and the scholastic simple substance.

Yet Dr. McTaggart recognizes and insists on "the continuous development of the self."[43] But is this continuous development a development of the very essence of the self? Hegel's identity is

[41] *Ibid.*, p. 104. [42] *Ibid.*, p. 83.

[43] *Studies in Hegelian Cosmology*, p. 52.

an identity of process, an identity, not in spite of, but in and through, change and differences. For Dr. McTaggart personal identity is in the last resort an identity of substance. In all changes "there is an aspect which is permanent and unchanging, and it is on that aspect that our attention is fixed when we speak of identity of attributes through change."[44] Accordingly, the self's identity is not affected by its migrations from body to body, nor by the periodic snapping of the thread of memory and consciousness generally. All these circumstances are really external. The very fact that there is no evidence of the continuous persistence of these is, to Dr. McTaggart, a proof that they are not, after all, fundamental. "We may lay down a general principle as to the continuity of external circumstances from life to life," he writes. "In so far as it is necessary to the continuous development of the self, it will be present. In so far as it is not present, we may be sure that it is not required for the continuous development of the self."[45]

The above passage partakes of the dogmatic. *What*, after all, are all these selves which are solemnly declared to be the fundamental differentiations of the Absolute, but of which no known experience seems to be fundamental? Dr. McTaggart speaks of Reality as a society of selves, a system of personal relations, but his selves and persons are really monads, substantial entities. Hence the unreal character of what he represents to us as personal identity and continuance, immortality and preexistence. These scarcely seem to concern the concrete living self of experience. It is difficult to see "what special interest a man can take in the unknown series of those who are to inherit his soul-substance, any more than in the equally unknown series of those who had the usufruct of it before him."[46]

Leibniz's monads are self-complete individuals, but the totality of them does not form a cosmos. Dr. McTaggart's monadism would overcome the difficulty which Leibniz tried, and failed, to meet with his preestablished harmony, by conceiving of the finite individuals constituting the universe as selves. Selves, being necessarily in relation, do form a cosmos. But Dr. McTaggart's selves, conceived in too substantialist terms, fail to allow for an adequate recognition of the actuality of the impersonal factors in the world of self-activity, or for an adequate interpretation of the metaphysical role and significance of consciousness.

[44] *Ibid.*, p. 38. [45] *Ibid.*, p. 52.

[46] Professor Pringle-Pattison in *Hibbert Journal*, Vol. V, No. 1, p. 200.

perceived sense-datum. Thus if I receive a letter from America I am bound to think that this letter, in some sense, existed continuously from the time it was written to the time it was received. But during that period it was perceived at odd moments only and by a few persons, i. e., by the writer, some postmen and sorters, and myself. If it took three weeks to deliver it was not actually perceived for more than a few minutes. Thus, on Mr. Russell's theory, this particular collection of sensibles was, for some weeks, nothing but a collection of *unperceived* sensibles.

And it is easy to show, I think, that this assumption of the existence of unperceived sensibles, implied by Mr. Russell's theory, is really a very difficult one. If I am at liberty to assume that *any* of the sense-data which I *should* perceive *if* I looked at the letter, literally exist when I do not perceive them, I am also at liberty to suppose that the sense-data which a rat, or a fly, or an astigmatic octogenarian in the throes of sea-sickness would perceive might also literally exist at any time or place. According to this theory I make no difference to possible sense-data by actually perceiving them. When I open my eyes, standing erect, I merely select some of them. Similarly, I merely select some of them when I am giddy or stand on my head. If the former were there all the time, why not the latter? Any theory which avoids this consequence is surely, *pro tanto,* simpler; and if sensibles exist only when they are sensed, and the differences in them are due to differences in my nervous system when related to other physical objects in an unusual fashion, this consequence is avoided altogether. *Because* the physical objects are the same they *must* cause differences when differently related.

This is the main point, but perhaps I should say something concerning Mr. Heath's other criticisms. I never said that "the sole aim of science cannot be descriptive because models are widely used" (Heath, p. 449), whatever this extraordinary statement can be taken to mean. I said that the sciences are inductive as well as descriptive, that induction is inference, and inference not description. I added that models are illustrative and always contain more than a bare skeleton of logical relationship, so that if the goal of science is the discovery of logical relations, any model must contain an irrelevant addition.

For the rest, Mr. Heath argues that Dr. Schiller's view is at the back of my contentions; and he then attacks Dr. Schiller. I thought I had put my contentions pretty well to the front and I

disclaim this identity. In any case, Dr. Schiller is very well able to defend himself, but I do not see why I should be dragged into this particular *fracas*.

Perhaps I may be permitted to add that the sentence in my article beginning "If, then, all truth is discovery" (p. 343) has a "not" omitted by some one's inadvertence. It should continue "it is hard to suppose that *this* discovery should *not* have preeminent importance," etc.

JOHN LAIRD.

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In reply to Professor Laird's courteous note I should like to deal with two points only.

1. I did not intend to belittle those grave difficulties in the way of a thoroughgoing logical atomism which Professor Laird has so well expressed. My sole object was to show that the complexities introduced by the enormous number of *sensibilia* are not inconsistent with the use of Occam's razor. For, in limiting—as it does—the *type* of entity assumed, the use of the razor by Mr. Russell may well lead to complexities of description of any perceptual fact. Harris's zoo may have to be consulted, as Professor Laird suggests (p. 334). And yet to condemn logical atomism as inconsistent with the principle of parsimony is to confuse the latter, as I am still inclined to think Professor Laird does, with Mach's "principle of economy." For the economy contemplated by Mach was economy of description, and *that* is attained by an immense multiplication of entities—atoms, electrons, and the like. That is why, as Professor Whitehead puts it, physicists and chemists "have dissolved the simple idea of an extended body, say of a chair, which a child understands, into a bewildering notion of a complex dance of molecules and atoms and electrons and waves of light. They have thereby gained notions with simpler logical relations" (*The Organisation of Thought*, p. 131). On the other hand, the "principle of parsimony" seeks economy in the kind of entity assumed, accepting the resulting compexity of description with unconcern.

2. This leads me to my second point. It is true that Professor Laird does not argue in so many words that the sole aim of science cannot be descriptive because models are so widely used. But he *does* urge that if the sole aim of science is descriptive there is no justification for models. And that is sufficient for the purpose of

my criticism. He says (p. 329), "If the sole aim of science were the discovery by analysis of the logical relations between phenomena, a large number of suggestions in scientific works would have, at best, the value of mere illustrations. For instance, the desire to suggest or construct a model acting according to any given formula would have no scientific justification. When the equations have been discovered, where is the need for a model?" Now models never are used "when the equations have been discovered." Their function is to help forward the discovery of the most general equations. Thus Maxwell's electro-dynamical models served as stepping-stones to a descriptive mathematical system of a more general form than could have been readily developed without their use. As Boltzmann pointed out, in Maxwell's later papers and in his text-book the formulas more and more detach themselves from the models. Hence I contend that, even if science simply seeks general descriptions of the relations holding between phenomena (which is what I meant by speaking of its sole aim as descriptive), there is still a legitimate place for model-building. For that process is not just an incomprehensible little game scientists amuse themselves with, but has its own special function in the development of generalized descriptions.

In conclusion, may I say that I regret having forgotten how unwelcome (and even dangerous) it is to see similarities in the views of rival philosophers. But when Professor Laird, noting that Mr. Russell's use of the razor leads to a theory simpler only in certain respects, concludes that the whole process is rendered "subjective" (p. 332), then there is surely some similarity to Dr. Schiller's claim that it is not "ethically neutral." However, as Professor Laird says, Dr. Schiller can take care of himself.

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A FORGOTTEN PHILOSOPHER.

M. Remy de Gourmont, in a charming little essay on Helvetius in the third series of his *Promenades Philosophiques* (1909), expresses the belief that it is a good symptom, as regards the state of our intellectual health, that, thanks to the efforts of M. Albert Keim, Helvetius has been made the fashion again. He goes on to say: "To-morrow it will be Holbach, D'Alembert, and Tracy, the master of Stendhal; all these eighteenth-century philosophers, so simple, so clear, so human. Absurd German metaphysics has annihilated them for sixty years, but it would seem that their day of *revanche* is at hand. The dry notion of abstract duty according to Kant has had its day. People are beginning to understand that the first duty of man is to be happy. If not, of what use is life?"

For several years I have felt deeply grateful to M. de Gourmont for this kindly prophecy, it having fallen to my lot to rescue Holbach from oblivion, in an academic sense, although I could hardly be said to have made him *à la mode*. However, I am emboldened to pursue my studies of obscure French philosophers of the eighteenth century, such as Holbach, N. A. Boulanger, and Volney, knowing that M. de Gourmont's shade approves. Such knowledge is not without sweetness to a devotee of the author of *La nuit au Luxembourg*.

Holbach, very few will remember, was a wealthy patron of philosophy and an intimate friend of Diderot. His salon was the meeting-place of the Encyclopedists whose activity helped so much to prepare the intellectual ground for the French Revolution. Holbach himself, although an amateur, translated and wrote some fifty books on science, theology, politics, morals, and philosophy, only one of which is widely known, the famous *Système de la nature* published in 1770. This book is a frank exposition of scientific materialism, atheism in the good old eighteenth-century sense, and a kind of socialized Epicureanism, which created such a sensation in its own day that religion had as its protagonist against this monster no less a person than Voltaire. Holbach died early in 1789 without enjoying the fruits of his labors in behalf of a new heaven and a new earth.

Holbach's philosophical ancestry is easy to trace. As M. Soury has said in his *Bréviaire de l'histoire de matérialisme* (1881), "this

noble and ancient doctrine, materialism, has enlisted some of the finest minds and the most serene figures of all the ages; Democritus, Epicurus, Lucretius, Gassendi," and he might have added, Holbach, whose debt to Lucretius and Petronius is obvious. Holbach also supplied the notes for Lagrange's translation of Seneca, and urged his translation of Lucretius. He also owes much to Hobbes, Locke, Spinoza, Condillac, as well as to the German natural science and English rationalism of the seventeenth century. His obligation to his immediate predecessors in France is great, among the most obvious being Bayle, Saint-Evremond, Fréret, La Mettrie, Burigny, Bourgainvilliers, Boulanger, Dumarsais, and Mirabaud. His debt to his contemporaries, Diderot, Helvetius, Raynal, and others is by no means to be disregarded.

Holbach's influence on young men like Naigeon and Lagrange, who spent years in his company, is direct. He also knew Condorcet, Volney, and Cabanis, who frequented his salon in its later days, but were more assiduous at Mme. Helvetius's, whose salon at Auteuil perpetuated the philosophic traditions of his own. St. Beuve, in his *Causeries*, J. H. Fabre, author of *Les Pères de la Révolution* (1910), and Picavet, in his excellent work on the Ideologists, are certain of Holbach's influence on these men and on Destutt de Tracy, Dupuis, Garat, Brousais, Drouis, and Cousin; and there can be no doubt that this influence extended to other ideologists and philosophers of the Revolution. This, however, is an interesting problem yet to be worked out.

Perhaps the most important question relating to Holbach is his exact contribution to the Revolution. It is generally admitted that there is a relation between the philosophy of the eighteenth century and subsequent events. A revolution was prophesied by the clergy of France in an official utterance as early as 1765, and foreseen by Argenson, Voltaire, Grimm, Seguier, and others. All the hostile writers of the time lay the blame of the Terror on Holbach and his *conjuration philosophique*, whereas the most favorable authors give him his share of the credit due to the reformers. It is certain that his works were widely diffused at this time in popular form, and M. Picavet points out that the Constituent Assembly and even Louis XVI himself, in his letter to the Assembly in 1791, used the language of Holbach and Helvetius. Excellent examples of the ecclesiastical and royalist reactions to Holbach are to be found in such books as Abbé Barruel's *Mémoire pour servir à*

l'histoire de Jacobinisme (Hamburg, 1798), and Mme. de Genlis, *Les dîners du baron d'Holbach* (Paris, 1822), both of which are absolutely unreliable. Among revolutionary works representing the influence of Holbach are those of Naigeon, Holbach's literary executive, Silvain Maréchal's *Dictionnaire des athées* (Paris, An VIII), and two books of J. M. Lequinio, *Préjugés détruits* (Paris, 1792), and *Philosophie du peuple* (Paris, 1796). There are doubtless many other works of a similar character that on careful study would reveal the influence of Holbach. He was even taught in the *écoles centrales* in the year VI, and Roederer treated of morals at the Institute the next year, quoting with enthusiasm from Holbach, Volney, and St. Lambert. A curious reference which may be regarded as typical of the way Holbach was received by the men of the Revolution is to be found in the introduction to his *Essai sur les préjugés* (Paris, 1822). It occurs in the account of the life of Dumarsais, the supposed author, written by the "citoyen Daube" in the early days of the Republic. "One citizen at least will be found in every village who will buy this book, and each Sunday instead of vespers or compline or a tiresome and often fanatical sermon, will read to his assembled fellow-citizens a chapter from this 'Essay on Prejudices.' And what may we not expect from country people when Dumarsais shall become their guide! The primary school teachers will read some pages of this to their pupils every day for their instruction. Instead of giving them practice in reading from the New Testament written in bad French they will teach them reading, rhetoric, and logic from Dumarsais." It would be an interesting problem to determine just how far Holbach really did influence the thought of the Revolution.

It would seem that Holbach had influenced rather widely subsequent revolutionary and radical thought. Picavet has pointed out the affinities between his system and the *attraction passionelle* of Charles Fourier, and he seems to have points of contact with Prudhomme and Robert Owen. In 1844 Louis Blanc was accusing Marx and Arnold Ruge of being the followers of Holbach and La Mettrie. On the other hand, a Marxist like Plekhanov, in his *Beiträge zur Geschichte des Materialismus* (1896), insists on the relation of Marx and Engels to their real philosophical predecessors, Holbach and Helvetius. In Germany L. Noak has sung the praises of Holbach in his *Handwörterbuch zur Geschichte der Philosophie* (1879), only to be duly reprimanded under the auspices of the

Görres-Gesellschaft. On the other hand, Holbach has been credited with influencing Max Stirner, David Strauss, and E. von Hartmann. From time to time one sees his name in socialistic writings, whereas Kropotkin claims him for the anarchists. All this leads one to suspect that an attempt to determine Holbach's influence on this school of thought might be productive of most interesting results.

Holbach is closely related to Auguste Comte. In a word, his philosophy is positivism. Men like Stupuy and Littré have recognized this and become enthusiastic admirers of Holbach and Diderot. M. Fabre notes that Holbach speaks in the manner of Comte about the correlation between biology and sociology, and M. Soury points out that in founding politics and morals on biology he anticipated Pinel and others and hit upon an idea *"qui a passé en partie dans les faits."* This idea might have been further illuminated in a book entitled *La physique des mœurs* projected by Remy de Gourmont just before his death. It remains, however, for some historian of the social sciences to determine Holbach's share in the origin of this line of modern scientific investigation.

Holbach has touched English thought in a curious manner through his influence on Godwin and Shelley. This has been worked out by Mr. Hancock in *The French Revolution and the English Poets* (1899), but very likely could be traced further. Godwin read the *Système de la nature* in 1782 and proposed to write a work of like character for the English. Influenced by Godwin, Shelley read Holbach, Helvetius, Condorcet, and Volney, and in 1812 commenced a translation of the *Système de la nature* which he considered "a most eloquent vindication of atheism." At that time (July 29) he was at work on the third draft of *Queen Mab* and under the spell of Holbach gave Canto VI an anti-religious turn where before it had been merely anti-political. In Shelley's notes are to be found translations from Holbach, and the lines

> "A spirit of activity and life
> That knows no term, cessation and decay,"

are a transcription from the *Système de la nature.* Mr. Brailsford. in *Shelley, Godwin, and Their Circle* (1914), has shown how the enthusiasm of Mary Wollstonecraft for the education of women goes back to Condorcet and Holbach who was in a sense the first feminist.

After all the critics have finished, from Voltaire down to Brunetière, there still remain two outstanding facts to be empha-

sized in regard to Holbach: his almost unique position at one pole of thought, and his affinity with certain new sciences and intellectual movements.

Holbach stands at the end of a long process of theological disintegration. If there were opportunity it would be possible to trace this great change in the intellectual temper of Europe from the patristic period, through Catholic and Protestant scholasticism, Arminianism, Socianism, deism, rationalism, and finally to atheism, which in the eighteenth century seemed to so many thinkers the logical and inevitable conclusion of the whole matter. At any rate, one would seek far for a more drastic attempt to clear the intellectual atmosphere. Our present obfuscation is due to schools of thought derived from Spinoza and Kant, represented in theology by Schleiermacher and Ritschl, not to mention the still more primitive reactions of German romantic philosophy and English evangelicanism. Holbach was consistent throughout, and one must break with his premises or follow him to the end. The first alternative seems to have been chosen by certain schools of modern thought. Bergson derived part of his inspiration from Plotinus, whereas Eucken's romanticism was obvious. Even a scientist like James seemed to throw his weight on the side of philosophy, and there is a general tendency toward the unsettling of men's minds and a weaning them from the simple — perhaps too simple — tenets of rationalism. Abbé Galiani declared that Holbach had caused a complete bankruptcy of metaphysics. He was evidently mistaken.

There is, however, a modern school of thought that obviously harks back to Holbach and his associates. It is almost needless in the light of what has already been said to designate the physical, natural, and social scientists his *confrères,* together with those social philosophers and theorists who base their genial speculations on exact knowledge of man and his place in nature. All who are inspired by the evolutionary hypothesis are in a sense the followers of Holbach, whose central idea was the indefinite change that might be wrought in mankind by new knowledge of itself and its relations to universal nature. Holbach is shockingly modern. Many of his wildest guesses have become accepted scientific and social theory. His conception of matter as self-animated is finding expression in scientific works of the day, his inkling of the evolutionary hypothesis has long been amply corroborated, his mechanistic and unteleological notion of organic life forms a working theory for mod-

ern biology, as his idea of the continuity of the animal and human mind has more lately been taken as the fundamental hypothesis of comparative psychology. It seems needless to state how much modern social science and theory is beholden to the doctrine of materialism and a more or less biological habit of mind. One can only suggest how much Holbach with his naturalistic view of things may have contributed to what bids fair to prove a most fertile line of thought. It remains for some careful scholar to determine the value of that contribution.

The foregoing statements are necessarily brief and inadequate. The problem has been to compress a great mass of material rather than inflate a thin film of knowledge. This present paper, therefore, can scarcely be considered more than a catalog of facts, a kind of guide-book to Holbach. There can be no doubt, however, that he deserves a more prominent niche in the history of thought than he now occupies. M. Lanson has assured me that there was a great movement *caché derrière le déisme*, namely, the anti-theistic movement led by Holbach, which has not been explored or exploited as yet. What it might yield in the way of a general clarification of thought, no one can say. At least it would form one chapter in the history of man's mind yet to be written, which, if it were done in a scholarly spirit of coolness and calm, might elucidate an intellectual problem of universal utility and interest.

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CHARLES A. MERCIER.

1852-1919.

Dr. Charles Mercier, who died on the 2d of September, 1919, was a practical alienist physician and the author of several books, of which the most important are *Criminal Responsibility*, *Crime and Insanity*, *Crime and Criminals*, and *Conduct and Its Disorders*. He was born in 1852, the son of the Rev. L. P. Mercier, a clergyman of Huguenot descent, and as his family was left badly off on his father's death, his early years were spent as a cabin-boy and warehouseman in a woolen warehouse in the city before he took up medicine as a career. He took a high degree at the London

University, and became F.R.C.P. and F.R.C.S. The bent of his mind was toward the study of mental diseases and he gained a wide practical knowledge of these as medical officer in charge of the Bucks County Asylum and the City of London Asylum at Stone. He strenuously advocated a bill to legalize the treatment of insanity in its early stages, which was more than once brought before the House of Lords. In January, 1919, he was awarded the Swivey Prize for his book, *Crime and Criminals*, the same award he had received ten years before for his *Criminal Responsibility*, a work dealing especially with the psychological aspect of crime, and the states of mind accompanying criminal actions. This original work was the first to establish firmly the doctrine of taking into account grades of responsibility or just liability to punishment in all criminal charges. In *Crime and Criminals* Dr. Mercier, reacting against the theories of Lombroso, repudiates the idea that the criminal has any fundamental difference from ordinary men. To him "every man is a potential criminal," and the perpetration of crime is consequent upon a temptation which exceeds the resisting power or "breaking-point" of the individual. Dr. Mercier, besides his studies in psychology and insanity, was an opponent of Sir Oliver Lodge, and others who believe in the survival of human personality.

Of the subjects of which Dr. Mercier possessed a specialist's knowledge he wrote with a vigor and breadth of view not always found in specialists, and his work is marked by independence of authority and originality. He is not so fortunate in his parergon, *A New Logic*,[1] where he attacks what he imagines to be Aristotelian logic with the vigor of complete misapprehension; assuming that logic "is much in the same position that was occupied two hundred years ago by witchcraft. Without being formally attacked, it is crumbling to ruin, and losing its hold upon the minds of men."

[1] London: Longmans Green and Co.; Chicago: Open Court Publishing Company, 1912. Cf. *The Monist*, Vol. XXVIII, pp. 302ff.

BOOK REVIEWS AND NOTES.

SOME SUGGESTIONS IN ETHICS. By *Bernard Bosanquet, D.C.L., LL.D,* Fellow of the British Academy. London: Macmillan and Co., Ltd., 1918. Pp. viii, 248. Price, 6s. net.

This is an extremely interesting work by an able and distinguished philosopher. It not only consists of varied topics, but is in many places lighted up by apt concrete illustrations. The subjects of the chapters are: Living for Others; The Social Good; Value and Goodness; Unvisited Tombs; Doubting the Reality of Evil; How Is One to Know What to Do?; Something Worth Knowing; On the Growing Repugnance to Punishment; We Are Not Hard Enough on Stupidity.

I shall select only a few points for critical reference. The treatment of "Value and Goodness" is not in all respects quite unexceptionable. On p. 49 we have "worth or goodness"; on p. 57, "goodness or value"; on p. 58, "value, worth, or goodness"; on p. 64, "value or goodness"; and already on p. 49, "value and goodness." Value and goodness are found with both "and," and "or," between them. Such a use of the word "goodness," without explication, in a work intended only for "ordinarily thoughtful persons," does not, in view of its usual connotations, seem quite commendable or happy, and surely value and worth might have sufficed. Some extenuation for his use of the term might be found, however, in the fact that Dr. Bosanquet does not seem to adhere very strictly to the class of reader intended, for on pp. 67, 69, we find him dropping into talk to "the student," and on p. 68 to "the philosophical student." The treatment of value here seems rather loose, and lacking at points in qualities of precision and discrimination. In speaking of the satisfaction realized in value-experience, he tells "ordinarily thoughtful persons" that "to ask whether it is a matter of intellect or of feeling appears unintelligent" (p. 57). Most of them, probably, will think it would be "unintelligent" not to ask even so little, and may retort that Dr. Bosanquet himself has asked it, or he could not have said, "It is appreciable therefore both by reason and by feeling, and must always in some degree be evident in a reaction upon both, although either may predominate." Here he is content to leave the matter. Happily not all philosophical writers on value have been content without asking more, to wit, the extent and significance of this acknowledged "predominance"—of reason or of feeling. The result has been the distinction of reason or truth values from will and feeling values, which would have done more to elucidate the subject of value than anything Dr. Bosanquet has advanced. As things are, nothing is done to show that, though objects "satisfy desire" or have "the property of satisfactoriness," their truth is not thereby established. In other words, no hint is vouchsafed of the fact that a value-judgment is not a truth-judgment. In a much later chapter he claims, indeed, that knowledge of values "involves knowledge of facts in a certain way and bearing" (p. 229).

"A certain way and bearing" may leave delightful scope for lack of thoroughness as to the world of truth and fact. The statement that "truth" is "a value" is one for proof rather than loose assertion, and creates the unfortunate impression that truth is hopelessly relative, to which there will be many a demur. If truth was to be taken as "a value," the sense—that, namely, of its being the satisfaction of a want—should have been explicitly shown in which it was to be so regarded. The unsatisfactoriness of the truth reference may be largely due to its meagre and casual character, but the subject is too important for loose indefinite treatment.

The fourth chapter, on "Unvisited Tombs," is an interesting one, but two of its pronouncements will provoke dissent. It insists, rightly, that value is individualistic, and the theory of values directed to high achievement, but something of the nature of self-contradiction and anti-climax awaits us when it is said (p. 85) that "the honor and responsibility of an achievement can never truly and justly be laid upon any individual, not even in the crystallized achievements of poetry, knowledge, beauty." Such a pronouncement is likely to meet with as little acceptance as it deserves. There is not much incentive to moral strenuousness about it. Every one knows and admits that heredity, time, environment, etc., have something to do with the making of individual achievement, and you may therefore say, if you please, that it does not belong wholly or solely to the individual; but Dr. Bosanquet himself expressly recognizes that there are "disvalues" that might keep the achievement from being realized, so that the fact that the individual does not allow these to keep him from realizing the achievement makes it "truly and justly" *his* achievement—which, without him, were not achieved; and there is, therefore, a true and well-recognized sense in which the "honor and responsibility" belong to him. The "honor and responsibility" of being a Plato, a Dante, a Shakespeare, are "truly and justly" theirs, all accessory facts notwithstanding. "The general indivisible spirit of things" has not obliterated moral distinctions, and reduced the world to a blank, inane, featureless unity.

Again, it is said (p. 85) there is no need for "primary reliance on individual survival as instrumental to continuing or completing in his own person his earthly functions or their analogue." One's work, he goes on to say, seems to be "resuming its absorption in the general thought and effect of the world." What is said in that connection is true enough of the work, but is largely irrelevant to the question of the worker and his survival, which is the point in hand. An "absorption" of his work in the "general human value" will never content souls that have achieved high values; they will still claim the wages of going on and not to die. The values, Dr. Bosanquet himself has said, "wholly apart from persons would be nothing" (p. 11): that being so, what is more natural and congruous than such "primary reliance" of the persons embodying value "on individual survival" for the spiritual continuity, persistence, and expansion, of those values. It does not speak highly for philosophical progress that the century-old answer of Fichte to Dr. Bosanquet's "student" and "statesman" would have been higher and more assured than Dr. Bosanquet's, for he would have asked them to say in almost so many words, "As surely as I am, my existence is a thought of God; whatever I am, in and by this thought, I am before all time, and do remain independent of all time and change. This thought will I strive to know—to its fulfilment will apply all my powers; then

shall they be employed on what is eternal, and their result shall endure for ever." In any case, the two pronouncements of Dr. Bosanquet do not impressively make for the strengthening of the sense of individuality, and they are not so much ethical as merely ontologic.

There is a great deal in the chapter on "Doubting the Reality of Evil" to which I can give cordial assent, so much so that I am only reluctantly critical. Nevertheless, it does not seem to me to get to the heart of the subject. Its weakness lies in respect of essential moral evil. There is a Leibnizian strain running through it, and our finiteness and narrowness are accordingly emphasized. But, when everything favorable is said, there remain the same radical defects as are found in the Leibnizian philosophy of evil. Because developing being must be imperfect, it does not follow that it must be the prey of moral evil, and it is absurd to treat liability to evil as though it were evil itself. The essentially inward and ethical nature, quality, and conditions, of moral evil are inadequately grasped and grappled with. Dr. Bosanquet does indeed speak of "biassed choice," but the grave alternatives of moral choice are not pressed home to the seat or citadel of the situation. Thus, while one has largely enjoyed and endorsed his account, the unwilling conclusion of inadequacy forces itself upon the mind.

These critical references must not be allowed to obscure the fact that the book in whole makes good reading, and contains much sensible advice and many excellent suggestions. I heartily commend what its chapters have to say on life, literature, and art, as timely, sound, and wholesome.

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ESSAYS IN COMMON SENSE PHILOSOPHY. By *C. E. M. Joad*. London: Headley Bros., Ltd., 1919. Pp. 252. Price, 8s. 6d. net.

How far may the amateur trespass upon the province of the philosopher is the question suggested by Mr. Joad's essays. He attacks certain philosophical problems as an intelligent foreigner and translates them into plain language for the plain man, and in so doing he is serviceable to the plain man, in providing him with a lucid, non-technical introduction to one or two questions.

The essays expound the New Realism, and are as the author claims, "sufficiently philosophic to sound singularly like nonsense to the plain man, while they are sufficiently akin in spirit and conclusions to the plain man's view of the every-day world as we know it to appear pedestrian and unsatisfying to most philosophers." He abandons any attempt to synthesize and unify the conflicting appearances of a world of sense into a correlated self-explanatory whole, and accepts an aggregate of things without apparent design or structure. He applies the realistic attitude of mind, as defined in the Introduction, to the relation of thought to temperament, pointing out that a man's philosophical opinions are really colored by his temperament, and to the theory of the State, dissenting here from the orthodox political theory as put forward by Hegel, T. H. Green, and others. The New Realism, which he recommends, "has taken much of the stuffing out of philosophy," and Mr. Joad's book, treating salient problems more shortly and less ambitiously than most philosophers have treated them, has its uses, and can be read with profit. M. J.

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THE MONIST

SPACE AND TIME.

I. SPACE.

FEW categories have aroused more controversy than has space. The reason for this divergence of opinion lies, in part, in its basic character; in part, in its various forms and implications. Let the reader ask himself whether he can conceive the physical world apart from space? Does he not even locate—vaguely enough it may be—even his own sensations and emotions? Again, how many perplexing problems cluster around space as a center! Is the world infinite in extent or finite? Is it infinitely divisible? Is space a receptacle in which things somehow exist, or is it simply a term for the peculiar order of things? What is the relation between space and time? Are they absolutely antithetical as Bergson holds? Or are they supplementary and in a way correspondent? Is space reducible to time as some empiricists have held? Has each of us a private space? And, if so, is there a common space? Is space an entity, or subsistent, as neo-realists maintain? It is evident that enough questions can be, and have been, asked about this category. It would be easy to find material to write a weighty tome upon this category alone.

The consequence of this varied approach is that the field has become very complex; and so the unwary thinker is apt to become confused as he attempts to find his way about in the heaped-up literature. Each specialist envisages the topic from his own angle, and, in trying to be thorough, succeeds in making a treatise. In such a situa-

tion, it requires some temerity to attempt to cover the philosophical essentials in a brief article. And yet this is our task. But we can pluck hope from the fact that process and result are in a way incommensurable. Just as years of experimentation can be condensed into a single formula. so years of reflection and persistent pushing-through of a point of view can find relatively brief expression.

Space is a strategic category. The physical realist is called upon to defend its validity and self-consistency against the attacks of idealists. Important as this task is, I do not think that it is very difficult. Mathematicians have of late aided the philosopher by their very able analysis of space as a subsistential content involving position, order and distance. The majority of neo-realists have followed them in this work. But the critical realist has the further task of appreciating space as a category concerned with the physical world. The physical world is not simply subsistential space, and yet it has a "form" to which the character of such space is applicable. Scientific knowledge about nature contains spatial order as a primary ingredient. Physical existents can be located with reference to one another.

When the critical realist thinks of space as a category, he does not mean that space is a physical reality. He means only that valid knowledge of physical reality contains elements which can be universalized under such headings as distance, position, size, etc. We shall treat the category of quantity as intimately bound up with space, while fully admitting that there are quantities which are intensive rather than extensive. Knowledge of the physical world, then, contains such judgments as *that* this thing is to the right of that, this thing is ninety million miles from the earth, *that* these things are measurable in terms of an arbitrary unit adopted as a standard. All this is preliminary knowledge, if you will, but it is none the less valid.

This defense of space as a valid category marks one of the essential differences between a realistic naturalism and all forms of spiritualism. The antipathy of spiritualism to space is well known. Leibniz, its first protagonist, attacked the objective validity of space and maintained that reality consists of spaceless points which are in themselves immanently evolving spirits. For Schopenhauer, also, space is phenomenal and has no objective validity. Reality is of the nature of will. This agreement is no accident, for we find in Bergson, likewise, a tendency to belittle space at the expense of duration in consciousness. Space is stated to be homogeneity and simultaneity, while the self reveals itself to intuition as an interpenetrating flow of qualities. Space is here a sort of *pièce de résistance,* and the exact status of space and matter is not very clear; yet it seems certain that for him the higher levels of reality are non-spatial.

With the general attitude of neo-realism toward science the critical realist is in the heartiest sympathy. Still, the profound difference in epistemology has its necessary consequences.

The neo-realist is nearer naive realism than is the critical realist, yet he champions the non-mental reality of such entities as space, time and number. When he includes values of all sorts, he is led to attack naturalism with the fervor of the Platonist.[1] Neo-realism and Platonism have much in common; critical realism and Platonism have little in common. Of course, values are real just as sentiments, desires and judgments are. But they are entirely human affairs.

Evolutionary naturalism is a critical naturalism. It distinguishes between objective contents in the individual's experience and the physical objects of his knowledge. Thus

[1] Cf. Spaulding, *The New Rationalism,* p. 498. (Why not a "new naturalism" as well as a "new rationalism"?)

critical naturalism can do as full justice to mathematics and logic as Kant and Locke tried to do. The weakness of the older naturalism was its unreadiness to do justice to the reality of mind, mental entities and values.

A Genetic Approach.—We shall find it true of space—as of the other categories—that it has different levels and contexts. Therefore, our first task must be the separation of these levels and a relation of them to their proper universe of discourse.

The more highly developed kinds of space, while not simply reducible to the more primitive types, cannot be understood apart from them. They are a development, a clarification, of them. The categories which we apply to the physical world have their birth in the field of perception. It is this point which I wish to emphasize by this genetic approach. Discrimination and reflection play their part, but they must have material on which to work. This material consists of sensible characters given in consciousness.

Sensational Space.—The philosopher does not feel it his task to trace the spatial experience of the adult to its beginnings. It is for the psychologist to discover the various factors whose active synthesis leads somehow to the perceptual level at which we all naturally live. Enough along this line of investigation has been done to convince the thinker that the process of fusion and development has been both a gradual and a progressive one. But the fact remains that we are not ordinarily aware of anything but the result. We live on the crest of the wave of experience and profit by all that has gone before; or, to vary the simile, we are like spectators in the theater who see the finished play and do not know what goes on behind the scenes. Assuredly, the adult's ability to distinguish position, distance and size is an accomplishment. "For those

who are born blind," writes Bourdon, "space is a synthesis of tactile, muscular and joint sensations, and particularly of the tactile, muscular and joint sensations of the fingers, of the hand, of the arm and of the lips; for the normal man, on the contrary, space is essentially a synthesis of retinal sensations with tactile, muscular and joint sensations of the eyes and of the head. Now a long time after sight has been given to one born blind, he will still keep his old way of representing space."[2]

Before passing to the level of normal perception as dominated by sight, touch and movement, it will be well for us to note certain data which are calculated to restrain us from dropping into the dead-level view of space which has so often appeared in philosophy and mathematics. Had Kant meditated on these facts, his theory of space could not have been so neat and simple. It is a well-known fact to-day that the spatial extensities primitive to different senses are not correspondent, that there is something of qualitative incommensurability about them. "The interior of one's mouth-cavity feels larger when explored by the tongue than when looked at. The crater of a newly extracted tooth, and the movements of a loose tooth in its socket feel quite monstrous. . . . If two points kept equidistant be drawn across the skin so as really to describe a pair of parallel lines, the lines will appear farther apart in some spots than in others."[3] Of course, very few of these and similar facts are noted in every-day life because the interest of the individual is not directed toward them. We live in a space which has gradually been standardized because of our need to adapt ourselves to our environment, physical and social.

Perceptual Space.—Perceptual space arises at a level in which the synthesis of the various sources has been

[2] Bourdon, *La perception visuelle de l'espace*, p. 362.

[3] James, *Psychology*, Vol. II, p. 139.

pushed a long way. The role played by meanings and cues is the evidence of this fact. Visual and tactile space have so intimately been brought together that we pass from one to the other without any sense of difference. The one has come to mean the other in our spatial interpretations of things and distances and positions. But the part played by movement in the growth of perceptual space, as a sort of continuum of things in which we experience ourselves as living, can hardly be overestimated. Motor experiences organize, suffuse and knit together interpretatively the material contributed by sight and sound. Our vital interests are always forcing us to note positions and to estimate distances and directions, sizes and contours. Space becomes an affair of discriminations and estimations within a realm of apparently given things.

Now the perceptual level is likewise the level of things, their qualities and relations; it is the stage of common-sense realism. As we should expect, perceptual space reflects this situation and appears in completest harmony with it. Things have size, shape, position; they are at certain distances and in certain directions from one another. Space is not a thing, rather is it the complex of these characters. The whole perceptual field arises together as both quality and structure. The older philosophers and psychologists used to speak of an act of objectification by means of which the self passed from sensations to things. A little reflection should convince us, however, that objectification is a growth and not an act. It represents the passage from the vague and inchoate to the relatively clear and structural. Sensations are not first experienced in the head — how could they be? — and then extruded in some mysterious fashion. Objectification is a functional growth rather than a unique act.

Perceptual space is, then, the spatial character of the field of the individual's experience. It is a character which

ministers to all the meanings of thinghood and independence. The book which I see in front of me is appreciated by me as at once self-existent, perdurable, composed of printed paper, of a certain size and shape, so far distant and in such a direction.

But this spatial realm of perceptual things has three main characteristics which each one can verify for himself, and which are of considerable philosophical interest. It is, first, limited in extent. Our horizon always has a boundary, and near objects are more distinct and better defined spatially than are far ones. In short, each one perceives a concrete manifold of objects which is limited on both sides and also in the third dimension. I can see only so far in front of me and am compelled to turn my head in order to see objects too much to one side. In the second place, perceptual space is sensibly continuous, or unbroken by that which is non-spatial. It is obviously impossible to escape the presence of space in perception for it suffuses and relates the content of the field. All things have position. What we perceive in vision is of one character so far as extensiveness is concerned. Spatial material is at the heart of it genetically. If the term be not misunderstood, space can be called a *form* of things, that is, an omnipresent character with which we can contrast other, more variable features like color and odor. Space is a constant character of the field, while other characters undergo successive change. These elements vary independently. A thing may change its color while not changing its place; and, again, it may change its place without changing its color.

Empiricism vs. Nativism.—Psychologists and philosophers were long divided upon the question of the comparative innateness of space-perception. This problem is more a psycho-biological than a philosophical question,

that is, it is a question of genesis rather than a question of content and validity. But I do not think that it is going too far to assert that the historical controversy between those who believed space to be an innate possession of the "mind" and those who sought to derive it from elements essentially non-spatial in character has ceased in large measure to be a real one. The original antithesis has been outgrown in these evolutionary days. The Kantian form of nativism, called by Stumpf the psychic-stimulus theory, asserts that space is an innate form of the "mind" in which the chaotic manifold of qualitative sensations is arranged. Kant assumes that form and qualitative content are derived from different sources. The Humean type of empiricism sought to derive space from the arrangement (?) of qualitative points.

Kant's schema has many obvious weaknesses: it has a view of the mind which we would hardly accept to-day, and assumes that all connectedness is contributed by the agency of a transcendental ego of apperception. As a matter of fact, relations appear to be as sensuous in the first place and as naturally given as any other features of the perceptual field. The Kantian machinery strikes the present thinker as extra-natural and uninforming; and Kant's formulation is, historically, an attempt to supplement Hume rather than to make a thoroughly new analysis.[4]

That all perception rests upon, and involves, processes of discrimination and interpretation is a commonplace of to-day, but it was not so in Kant's day. That much should be pointed out in apology for Kant's formal intellectualism. Where we see genetic process, Kant saw a formal operation. It was this formal operation which involved the coming together of two unlike mental factors, the *a priori* and the *a posteriori,* the one contributed by the mind in a

[4] Cf. *Critical Realism,* Ch. 6. William James and James Ward—among others—have subjected the Kantian psychology to severe criticism. I hardly feel that there is need to kill the already slain.

free way, the other caused by something outside of the mind. We cannot permit a nativism which assumes an *a priori* element of this sort. All elements are innate in the sense that they are functions of the brain-mind under stimulation. The following quotation is, I think, a fair statement of contemporaneous psychological opinion: "We hold that the crude, vague feeling of extension, of volume, is a genuinely innate experience, unlike any other experience, and underived by mere experience from non-spatial psychical elements. So far we are nativists. On the other hand, we are confident that all accurate knowledge of the meaning of the space relations in our space world, all practically precise perception of direction, position, contour, size, etc., is a result of experience, and could never be gained without it. So far we are empiricists, holding to a *genetic* point of view regarding the development of our adult space-consciousness."[5] The spatial character of the field of objects which we suppose ourselves to perceive is a discrimination gradually achieved through material lending itself to the distinctions.

The Truth of Perceptual Spatial Judgments.—We have already suggested that judgments usually imply the setting of common-sense realism. That is, the judging individual is convinced that he perceives self-existent things which are the sources and centers of such executive agency as finds place in his world. He, himself, is only one—though a unique case—of these manifold things. In veridical perception, he becomes aware of such things and passes judgment upon their characters and relations. His sense of things does not always appear in explicitly judgmental form, but it can easily be so analyzed; and the judgments resulting will be considered true. Thus this red book in front of me is oblong in shape, quite thick, medium octavo

[5] Angell, *Psychology*, p. 141.

necessary end. But it is important to note that space is still neither a thing nor a semi-reality, for it is inseparably intertwined with bodies. It is not a receptacle into which things are put but a distinguishable character of related things. The world is not so much in space as it is spatial or extended.

Science deepens our appreciation of the spatial character of bodies. Common sense, being limited to surface views, misses the knowledge which comes from the combination of cross-sections. Mechanics with its study of stresses and strains, physics with its appreciation of interdependence, chemistry with its theory of rings and stereoisomeric substances, biology with its discovery of structure, all deepen the spatial aspect of things. He who has studied the detailed structure of the nervous tracts can hardly deny the reality of position.

Mathematical Space.—But the observational and experimental sciences are not the only sources of our deepened knowledge of space. They are the only basis of actual knowledge of the spatial nature of particular objects, it is true, but they are assisted by an abstract science which studies spatial characters as such, viz., mathematics. It is this non-physical science which assists the physical sciences through the setting-up of a correspondence between their material. The position we shall adopt is, that mathematical space is an abstractive construction resting ultimately upon characters gotten in perception. Mathematics is an intense study of the nature of spatial relations. The information it acquires is, therefore, interpretative of physical relations. If a body is a sphere, the results deduced mathematically about a sphere are relevant to my thought of this body.

The empirical basis of the ultimate material of mathematics is indicated by the history of the subject. But this material is conceptualized and studied intensively and in the

light of all sorts of methods. Analytic geometry and calculus are examples of what I mean by this inventive, intensive study. The results are, however, applicable to the material to which they are instrumental. It is for this reason that calculus is as instrumental to the physical sciences as is geometry, which is far more directly related to perception. In other words, the material of physical science overlaps in part the material of mathematics. I agree, then, with James Ward in his criticism of Kant: "Given only the pure space of Kant and the geometers, it is impossible to deduce the actual space of experience; but, given this, the deduction of that is intelligible."

Now how does this construction arise? We have already seen it well under way in our examination of common, empirical space. We learn to abstract the spatial features of bodies. In this way is obtained the concept of an empty space homogeneous in all directions. There can be no doubt that this process of abstraction is aided by the fact that bodies change their places, that is, their relative positions, while retaining their forms. This experience of rigid bodies which move from place to place enables the mind to advance to the conception of space as such, to spatial characters as such. This genesis has left its trace upon the geometrical concept. Just because rigid bodies have dominated our experience, we tend to think of the parts of empty space as immovable and exclusive of one another. What we do is to remove thinghood and non-spatial characters from the empirical expanse of ordinary perception. It is for this reason that I affirmed that content is emphasized in mathematical space and reference omitted. Mathematics is a non-existential science; it is not a science directly concerned with the physical world, even though its information is valuable for the physical sciences.

There are to-day both metrical and non-metrical geometries. So soon as geometrical objects are thought of as

having size, we enter the domain of metrical geometry, which is decidedly the more primitive type. But how is it possible to measure the magnitude of a geometrical quantity? Primitively by superposition.[6] The geometrician must be able to distinguish the two elements of position and form; and he determines equality by such a relative displacement as results in coincidence. "The figures are equal," writes M. Poincaré, "when one is able to superpose them; in order to superpose them, it is necessary to displace one of them until it coincides with the other: but how can one displace it? If we ask this question, it will be replied without doubt that one ought to do it without deformation and *after the fashion of an invariable solid.*" It is from this situation that the geometrical axiom of free mobility arises: Spatial magnitudes can be displaced without deformation. Now this axiom bears witness to the origin of mathematical space.

But mathematics has recently passed through a stage of reflective analysis in which search has been made for the smallest number of axioms which could bear the weight of a rational construction of different mathematical systems. For all the elements and processes involved, definitions are sought. There is, however, no real conflict between this demand and the acknowledgment of the genetic origin of the construction which is thus being rationalized. Reflection clarifies, discriminates, abstracts, defines, and logically relates elements of content, but it has its cues and suggestions in the material which has first been intuited. Math ematical space is, in other words, a development of the characteristics of empirical space, such as order, direction, distance and area.

Perhaps the contrast between empirical space and mathematical space can best be brought out by an examination of the idea of space held by prominent mathematicians.

[6] Cf. G. Lechalas, *Etude sur l'espace et le temps*, p. 31.

This method of approach will also give us the basis for a better understanding of the ideality or non-existential status of mathematical space.

Newcomb defines space as the totality of all positions into which a body could possibly be moved, were no impediment to motion in existence. "This totality," he writes, "forms a continuum, the conception of which is so elementary and fundamental that no definition can materially aid in its formation. To us the parts of space are all those places, infinite in number, to which or in which a body can be conceived to move or exist, and *vice versa,* we can conceive any body to move into a part of the infinite continuum which is formed by the totality of those places. Space is continuous not only in the sense that every part joins to the parts around it, but that every part is susceptible of indefinite subdivision."[7] What I have said of the empirical source of mathematical space stands out clearly in every sentence of this article. Spatial characters are enriched by operations, potential and actual, to which there are no assignable limits. Let us now turn to Russell. In his *Scientific Method in Philosophy* he makes the following remarks: "I do not see any reason to suppose that the points and instants which mathematicians introduce in dealing with space and time are actual physically existing entities, but I do see reason to suppose that the continuity of actual space and time may be more or less analogous to mathematical continuity. The theory of mathematical continuity is an abstract, logical theory, not dependent for its validity upon any properties of actual space and time. What is claimed for it is that, when it is understood, certain characteristics of space and time, previously very hard to analyze, are found not to present any logical difficulty." Continuity and infinity are, then, logical concepts which are applicable to space and time as derived from

[7] Newcomb, art. on "Space," *Dictionary of Philosophy.*

experience and which enable us to analyze and handle these characters. In accordance with this logical effort, point, instant, continuum and infinite are assumed or defined. Continuity is a property of series, and a series is continuous when between any two terms whatever, however near, another one can be placed. Again, infinite numbers cannot be reached by counting: they are a class quite distinct from finite numbers and have properties peculiar to themselves. It should be noted what a part number-theory has played in the formation of these concepts.

Mathematical space is, then, continuous and infinite, and there is no self-contradiction in these concepts. But mathematical space is more a system of operations and elements than a given expanse. For instance, for mathematical purposes, any object may be taken as a point or position. Again, when a mathematician speaks of an infinite number of points between any two positions on a straight line, what does he mean? He means that this portion, like any other portion, is a continuum. In a continuum there is no *next* position but always one *between*, and so on indefinitely. Thus we achieve the conception of a compact series. To assert that a line is infinitely divisible is not to regard it as made up of self-existent entities which are discrete and distant but to indicate a process which has no limit. Positions are foci of a conceptualized attention. They are the homologues in abstract space of things in perceptual space. Positions imply other elements because they are inseparable from distance and direction. Or we may put the same conclusion in the following way: if points were spatial, they could be further divided; if they were spaceless, they could not make up a piece of line-room. Infinite divisibility is the expression of this relativity of position in the total character of space.

In his treatment of space, Bergson often seems to confuse this abstractive space of mathematics with something

purely external. He does not do justice to the subsistent status of mathematical space. Time, or duration, is internal and pure heterogeneity, while space is external and pure homogeneity. Besides, I do not think that many mathematicians would agree with him that number is inseparable from space.[8] These abrupt antitheses are not empirical; they are dialectical—just the sort of method that Bergson claims to avoid. Even abstract space is not mere simultaneity; it is position, direction and distance. And are not these elements qualitative characters? But we shall be obliged to reexamine Bergson's doctrines when we come to treat time.

It is also necessary to say a few words about the theory that space is reducible to time. This theory has taken two forms. First may be mentioned the older associationist stress upon the succession of sensations in the formation of tactual space. But they forgot that this succession was accompanied by the character of coexistence in the complex of sensations in the resting hand, and that this latter character dominated the interpretation of the total experience. Positionness and extensity are characters which function actively in the construction of space. An element in the process, such as the temporal succession of new experiences, can be used in the making of a product in which temporal succession is not an element.

The second form of the temporal theory of space asserts that space is but a reversible time-order. We can pass from *a* to *b*, *c* and *d* and then back again. Of course we can. Space permits the passage of our attention or of our overt action back and forth over things. But the temporal order is that of events; in this case, our acts. Action implies space and space lends itself to action. To reach a distant object, I must pass by intermediate objects. But

[8] I believe that it is generally held to-day that numbers are concepts. Cf. Shearman, *The Scope of Formal Logic*, Ch. 6.

this does not contradict the fact that these objects were, all the time, in the relation of coexistence in the order of side-by-sideness, the basis of direction. And, by the way, is not the very expression "a reversible time-order" a contradiction in terms? It is an attempt to combine the different qualitative orders of space and time. Our actions are reversible, but the time-order is not.

Space as a Category.—Having now gained a fair idea of the genetic basis of conceptual space and also some insight into its character as a subsistent content, we are ready to consider the validity and meaning of this content when used as a category of knowledge about the physical world. That world is for us reality, the very substance of being. And it is by an irresistible pressure of the material of knowledge that we think of it as extended. Some thinkers, it is true, hold that this pressure of our objective experience to consider reality spatial in its character, that is, to hold spatial predicates applicable to it, leads to a disastrous conflict between reason and instinct. But I think that even they must concede that the burden of proof rests upon them.[9]

Space claims, then, to be a cognitively objective category, to mediate knowledge about reality. Judgments of position, relative size, contour, distance and direction are, therefore, referable to the physical world. To say that these judgments are valid and contain information referable to an independent realm is to think this realm spatial, *for these elements give the very meaning of space as a category.* Space as a category is not a thing to be pictured. To assert that the physical world is spatial, means, not that the physical world is *in* a non-dynamic receptaculum analogous to mathematical space, but that certain predicates

[9] Cf. Bradley, *Appearance and Reality*, Ch. 4. For another reason, Bergson also attacks the validity of space as a category.

are interpretative of its actual constitution and nature. While we need not exaggerate the amount of information given by spatial judgments nor the depth of insight contributed by them, it is likewise unnecessary to deny their significance. The morphologist has his work to perform as well as the physiologist. An organism has structure as well as function. We shall learn, as we proceed, that the categories supplement one another and are intertwined in adequate knowledge.

An Historical Retrospect.—Science always acts as a stimulus to the active thinker, and he who does without this stimulus is apt to swing around in a dialectical circle, trusting all the time to the advent of some pictorial intuition. The first philosophical view of real space identified it with a void in which atoms somehow exist. This void, the μὴ ὄν of Greek philosophy, was a sort of semi-reality which could be filled and which could also remain empty. The fact to note about this outlook is its failure clearly to distinguish between mathematical space and the void. Physical reality is thought of as passively dispersed.

Plato identified matter and extension—just as Descartes did after him—and was led to reject the void of the atomists. But, here again, mathematical space tends to be reified. When Descartes asserts that the defining essence of matter is extension, he is in the hands of a mathematical rationalism which pretends to intuit reality rather than to gain an elementary knowledge applicable to it. He does not realize that mathematics is a non-existential science which can be developed for its own sake as well as be used as instrumental to the various physical sciences.

The development of mechanics gave rise to the Newtonian conception of nature which gave a semi-reality to space as such. For Newton, space is as a whole hyperphysical, an independent, fundamental variable in relation

to which the world directs itself. We are led to think of it as a connecting continuum in which things are. Thus its unity gives unity to the world of things in space. This means that the unity was not so much held to arise out of the nature of the physical world as out of this menstruum. It is only fair to Newton to point out that there have been different interpretations of his system, especially in regard to such a problem as action at a distance. Yet, when all is said, absolute space is for him a receptaculum. His system is impregnated with what may be called mathematical realism. Space as a category of our knowledge of the physical world is confused with the content of mathematics.

To make Newton's position somewhat clearer to the reader, let us glance at the teaching of a contemporary mathematician. In *The Problems of Philosophy* Mr. Bertrand Russell writes as follows: "Thus we may assume that there is a physical space in which physical objects have spatial relations corresponding to those which the corresponding sense-data have in our private spaces. It is this physical space which is dealt with in geometry and assumed in physics and astronomy." I interpret this position as similar to Newton's, although I must confess that Mr. Russell's philosophy is fundamentally unclear to me. What is this physical space? Is it the physical world conceived as spatial, that is, in terms of spatial predicates? Or is it a second kind of reality, a receptacle?

Faraday inaugurated another movement which may be regarded as a reaction against a conventionalized Newtonianism. His experiments led him to adopt the view that all physical action is mediated by intervening physical conditions. The physical world, in other words, has its own dynamic continuity and does not need to borrow it from a real, hyperphysical, absolute space. The whole drift of modern science has continued in this direction.

It is time that mathematical objects and content be separated from physical reality.

When I assert that a physical thing is extended, I mean that it is measurable in terms of units superposed directly or indirectly upon it, that it actively excludes other things, that its parts have a characteristic external order of position in relation to each other, and that these facts can be related to other facts which can be brought out by experiment. In this sense, I have the right to say that physical things are extended without meaning that they are in an absolute space as a sort of receptacle or that they possess an attribute of which I can gain an idea of a copy sort. Hence, to assert that nature is extended is to maintain that human knowledge about nature contains elements of a certain content. Physical space is, then, the physical world known as spatial. The more we know about the intimate structure of the physical world, the more we know about real space. So far as mathematics is of assistance to science, it does not come between nature and our knowledge as a disturbing factor, and the thinker must rid himself of the habit of assuming that physical things are in a homogeneous medium made of positions.

Kant's Antinomies.—Kant sought to prove that the assumption that reality is spatial lands us in certain contradictions which can be avoided if we once admit that space is phenomenal and holds only of phenomena. His argument has played such a role in the history of philosophy and is still taken so seriously that it must be examined.

Kant's thesis is, that the world is limited with regard to space, that is, that it has a determinate and finite size. His method is to point out the contradiction in the opposite assumption. "In that case," he asserts, "the world would be *given* as an infinite whole of coexisting things." But to the realist the expression "given" is ambiguous. Does

Is Nature Infinitely Divisible?—Mathematical space is infinitely divisible. But it does not follow that a physical thing is infinitely divisible. In the case of the one, we are concerned with an operation of thought correspondent with the nature of the material operated upon. In the case of the other, we are confronted with a problem of fact. Certainly, human beings cannot divide a physical thing into an infinite number of parts. The structure of things seems to be atomic. Of late, theories of energy have drifted in the same direction—as comes out clearly in the quantum-theory of Planck. Nature—to use James's expression—seems to bud off drop by drop. Infinite divisibility would seem to involve a passive sort of homogeneity; and this is alien to the dynamic, structural character of the world as revealed in experience. To substitute mathematical space and its characters for reality—however valuable instrumentally at times—is to beg the question.[11]

II. TIME.

The usual feeling in regard to time has been expressed by no one better than by Saint Augustine: *Quid est tempus? Si nemo ex me quaerat, scio; si quaerenti explicare velim, nescio.* No concept is more baffling and has more subtle apparent contradictions than has time. As one other writer has put it: "All things live in time and it lives in nothing; all things die in time and death is not able to attain it." But may it not be that it is this very mystical tendency to substantialize time that leads us into our difficulties? Because we have not sufficiently distinguished the various

[11] "On the discontinuity-theory, time, change, etc., would grow by finite buds or drops, either nothing coming at all, or certain units of amount bursting into being 'at a stroke.' Every feature of the universe would on this view have a finite numerical constitution. Just as atoms, not half or quarter atoms, are the minimum of matter that can be, and every finite amount of matter contains a finite number of atoms, so any amounts of time, space, change, etc., which we might assume would be composed of a finite number of minimal amounts of time, space and change." James, *Some Problems of Philosophy*, Ch. 10, p. 154.

meanings and contexts which the term has, we are the more easily led to regard time as a mysterious form or receptacle in which events somehow happen. Let us see whether we can treat this concept in a genetic fashion as we did space, and in this way succeed in relating each level to a context in which it becomes significant. We shall, I think, find that the preceding examination of space will aid us—especially in the study of kinetic and mathematical time. But there will also be important differences between space and time to note, due to the fact that each is *sui generis*. Each bears upon and introduces us to fundamentally distinct characteristics of reality.

The elementary experience which is at the foundation of what we roughly call time is the immediate feeling of change. "The mere fact that B follows A in consciousness does not of itself constitute the consciousness of B as following A. On the other hand, we must not jump to the conclusion that, because the sequence A B is not in itself the cognition of that sequence, it is therefore not experienced at all in any way. We must distinguish between consciousness of change or duration and change-consciousness or duration-consciousness. Change in consciousness may be felt without being cognized as change, and duration may also be felt without being cognized as duration."[1] What Professor Stout refers to here is the distinction between two mental levels. For instance, we can feel that there is a similarity between two objects long before we are able to analyze out the element which is essentially common to both. Cognition is a more reflective attitude which supervenes upon the relatively unreflective flow of experience. Probably no writer has brought out the significance of these feelings of change, these *transitive experiences*, better than William James; at the same time, James emphasized the difficult problem with which intro-

[1] Stout, *Manual of Psychology*, pp. 384-85.

spection is confronted in its search for them. "Let any one try to cut a thought across in the middle," he writes, "and get a look at its section, and he will see how difficult the introspective observation of the transitive tracts is. As a snowflake crystal caught in the warm hand is no longer a crystal but a drop, so, instead of catching the feeling of relation moving to its term, we find we have caught some substantive thing, usually the last word we are pronouncing, statically taken and with its function, tendency and particular meaning in the sentence quite evaporated."[2] As this writer points out, the denial that these transitive feelings or experiences exist has led to absurd mistakes in theory of knowledge. Sensationalism of the associational type was tempted into asserting that consciousness consists of sensations and their copies and derivatives "juxtaposed like dominoes in a game, but really separate." In other words, these early empiricists mistook the results of a partial analysis at a reflective level for the actual flow of experience and thus reached a false idea of the immediate data of experience. They reached such a false idea, not because reflective analysis is unveracious or falsifying, but because it was in their case controlled by preconceptions. They did not introspect delicately enough; they were too rough-and-ready and too biased. To-day, however, there is pretty general agreement that we feel change long before we analyze out the factors and think of them as in a sequence.

But the sense of change is only one of the elements which reflective analysis can note in perceptual time. Just as important is the feeling of duration or lapse of time. All individuals have an ability to estimate roughly the extent of duration of a process or activity. It is the task of the psychologist to explain the conditions of this sensing of duration. The indication is that it is connected, in part,

[2] *Principles of Psychology*, Vol. I, p. 244.

with certain recurring activities which help to give a rhythm to consciousness, and, in part, with what may be called the cumulative effect of the process of attending. "When we are listening to a sound," writes Stout, "our experience is different at the end of one minute from what it is at the end of two minutes, although the sound itself may not have altered in quality."[3] There is a qualitative difference in the experience, as time passes, which adds an experiential differentia to the sense of change and complicates it. The more we penetrate to the experience itself and remove, as it were, the images with which habit has veiled this experience, the more we realize its unique qualitative nature. If the aim is to be true to the experience itself, the picture of a stream or a line is totally inadequate. Let us call this interwoven sensing of change and duration the basic time-experience.

In personal time, we have, then, the immediate experience of both change and duration. These characters are data for the philosopher, although the psychologist may recognize it as his task to find their conditions. Moreover, we must admit that, as experienced characters, there is no contradiction between change and duration. A sense of the lapse of time fits in with the sense of change as its complement. While we cannot infer the one from the other, they harmonize so completely that there is reason to think of them as supplementary aspects of one complex experience. Both bear witness to the unity in diversity of consciousness.

The Specious Present.—The actual span of consciousness gives the experienced, or specious, present. This empirical present is not an indivisible instant of time but a changing span of some dimension. What its exact dimension is must be left to experimental technique to discover.

[3] Stout, *op. cit.*, p. 386.

The point to note is, that perceptual experience knows nothing of mathematical instants.[4] To assume them as is implied in the query, whether the felt present is made up of moments and is infinitely divisible, is to confuse levels and standpoints. It is the great advantage of the genetic method that it prevents the occurrence of such pseudo-problems.

The present is not an arrested span of consciousness but, rather all the consciousness there is. It is a flow whose content is always changing. "If the present thought is of A B C D E F G, the next one will be of B C D E F G H, and the one after that of C D E F G H I—the lingerings of the past dropping successively away, and the incomings of the future making up the loss. These lingerings of old objects, these incomings of new, are the germs of memory and expectation, the retrospective and the prospective sense of time. They give that continuity to consciousness without which it could not be called a stream."[5] If we disregard the complications introduced by memory and expectation, which represent an additional story added, as it were, to the current of perceptual happening, we are in a better position to gain clear ideas of the basic elements of the time-experience. These are developed and amplified by conception rather than changed.

The specious present is the moving content of the stream of consciousness. This span contains change of content, transitive feelings of a temporal sort, and felt distinctions which join with, and develop, the sense of change. In a

[4] "In short, the practically cognized present is no knife-edge, but a saddle-back, with a certain breadth of its own on which we sit perched, and from which we look in two directions into time. The units of composition of our perception of time is a *duration*, with a bow and a stern, as it were—a rearward and a forward-looking end. It is only as parts of this *duration-block* that the relation of *succession* of one end to the other is perceived.... The experience is from the outset a synthetic datum, not a simple one; and to sensible perception its members are inseparable, although attention looking back may easily decompose the experience, and distinguish its beginning from its end." James, *Principles of Psychology*, Vol. I, p. 609.

[5] *Ibid.*, p. 606.

chord of music played arpeggio, the various notes can be distinguished as both simultaneous and successive. They are heard together and yet in the order of succession.

Thus our perceptual experience presents us with four characters relevant to our idea of time, viz., change of content, sense of duration with a feeling of more or less, order of succession, and simultaneity. Along with these characters there is often another—the sense of growth or summation. This last character appears prominently in the experience of directed activity which has a goal. A more passive form appears in music. Heard melodies consist of tones which shade transitively into one another and yet mass together into a whole whose richness depends upon the musical capacity of the listener.

In the analysis of perceptual time, emphasis has usually been placed upon the irreversible order of succession characteristic of events. And yet, significant as this feature is. attention to it alone is apt to encourage a linear notion of time. It will be well for us to note the aspect of simultaneity of events as well as their succession. Simultaneity is the order of co-occurrence which characterizes many events. Consciousness is not thin and merely linear; instead, it is complex in content. I can hear the peal of thunder at the same time that I see a man scurrying across the street. In the busy streets of a city how many distinct actions can be noticed practically at once! We shall find that this order of events opens up a tremendous field for the imagination and lends itself to a significant development in science. Simultaneity will enable us to link time with space and give it a depth of location it otherwise is apt to lack.

The Addition of Memory and Expectation.—The "just past" and "not yet" of perceptual time are, it has been suggested, the germs of expectation and memory. But

their normal content, which is events and changes. We can note the order in which all events do come and consider it apart from any particular events. The order is, in this sense, the form of all possible events which must be simultaneous and successive with respect to other events. Thus there is a fundamental continuity between the genetic levels of the time-experience, what may be called an identity of essence. Mathematical time can, therefore, be instrumental to knowledge of the physical world in a way completely analogous to the space of mathematics. The material of knowledge is given in perceptual experience; and yet the more conceptual stages, which mental operations produce, develop and employ this material for conscious ends.

This identity between the essential characters of common and mathematical time being granted, we can proceed to discuss Kant's famous antinomy. We shall see reason to believe that it is as much of an error as that which was directed against the validity of space. Naturally, we shall grant to Kant that neither space nor time is a thing-in-itself. Our different epistemology sets a new formulation. We ask, Is time a category potentially or actively interpretative of the character of reality?

Kant seeks to prove the thesis that the world has a beginning in time by showing the absurdity of the opposite proposition. "For if we assumed that the world had no beginning in time, then an eternity must have elapsed up to every given point of time, and therefore an infinite series of successive stages of things must have *passed* in the world. The infinity of a series, however, consists in this, that it never can be completed by means of a successive synthesis. Hence an infinite past series of worlds is impossible and the beginning of the world is a necessary condition of its existence."

What we are here really dealing with is our conception

of time. Time is an order of successive events. Let us take a line and consider any arbitrary point as the present. Does it follow that I must think of the portion of the line, which extends to the left and symbolizes the past, as finite? Assuredly not. One of the initial mistakes of Kant was to start with an assumed past moment and work toward the present instead of with the present and working backward. So far as our thought follows the method of synthesis, we begin with the present; and the infinity of time means that there is no conceivable end to the movement into the past. Kant speaks as though time were a stream flowing into the present. There is a double danger in this approach: the image suggests a source, and we confuse our thought with the flow of things. An infinite flow does not involve a human synthesis of an infinite collection of events. The critical realist does not demand too close a parallelism between the process of thought and the process of reality. Thought is retrospective and supervenes upon reality. Hence, to think of the world-process as without a beginning is an empirical affair of which we find ourselves quite capable.

Time as a Scientific Category.—What kind of knowledge of the physical world does time cover? We shall realize in the case of time, even more clearly than in that of space, that human knowledge is not an intuition of the physical world. Knowledge implies intuited material and the use of that material in a cognitive way, but what is intuited is mental and not the physical object.

The first point to note is the character of the measurements upon which science builds its facts. Scientific time is at once a measurable quantity and an order of succession. Some process—preferably a movement—is taken as a standard, and other processes are referred to this unit. If two processes begin and end at the same time, they "occupy"

the same time. Let us take an example to make this method of measurement clear. Suppose that we wish to know how long a certain chemical process takes. We note the positions of the hands of a watch at the moment we put the chemicals together and also at the exact moment the reaction ceases. We measure the one process in terms of the other standardized one to which we relate all other processes. This measurable correspondence is the type of scientific time-quantity, and it is for temporal knowledge what the superposition of things is for the spatial knowledge of nature. In both cases, our knowledge consists of ratios, not of intuitions of inherent properties. Perception is a means to knowledge.

The standard process which science has adopted is, we have said, movement. It might have been other processes like the loss of heat by bodies, but practical conveniences led to the selection of movement. The point to stress is, that the prime requisite of the reference-process is its capacity for exact measurement. That processes, as we say, occupy time means two things: first, they are experienced by us as corresponding to an immediately estimated duration; second, that there are changes of a successive order. The scientist undertakes to measure these aspects and relate them to one another. What process is selected as a standard of reference and what unit is adopted are arbitrary so far as nature is concerned—a fact that makes us realize that knowledge is a human affair and is knowledge about nature rather than a reproduction of something external to man. But the ratios secured are not at all arbitrary. Given the method and the unit, and the result is determined by reality itself. Nature dictates a response to man's questions. But the questions and the language of the response are human.

When the thinker reaches this conclusion, he is led to seek confirmation in the more theoretical reflections of

scientists themselves. And it is interesting to find that scientists are more alive to-day to such questions than ever before. In every field there is an increasing demand for exact definition and discriminating analysis. In regard to space and time, the theory of relativity has produced a marked degree of reflection. Thus in his examination of the theory of relativity, Dr. Silberstein treats of the "definition of physical time or the selection of a clock or time-keeper, to be employed for the quantitative determination of a succession of physical events."[8] Let us consider his summary of the method adopted by science to work out a suitable standard.

"Suppose," he writes, "we do not limit ourselves to the investigation of motion only, but are concerned with every possible kind of physical phenomena, such as conduction of heat or electricity, diffusion of gases or liquids, melting of ice, evaporation of a liquid, etc., and that we propose to describe the progress of these phenomena in time, to trace their history, past and future. How are we, then, to select our time-quantity t?" Newton's absolute time flowing at a constant rate—whatever that may mean—could not help us since we have no clock to measure this absolute time. The result is that science selects some standard process like the rotation of the earth and adheres to it so long as it can relate other processes to it. When this cannot be done with ease, the standard process is examined more thoroughly to see if it is variable. "Thus astronomers have come to the conclusion that the earth as a clock is losing at the rate of 8.3 seconds per century and they have given up the earth as their time-keeper and substituted for the sidereal time t a certain function $T = \varphi(t)$, slightly differing from t, as their new 'kinetic time.'"

It is obvious that science has relinquished that naively realistic attitude toward kinetic time which still lingered

[8] Silberstein, *The Theory of Relativity*, Ch. 1.

in the mind of Newton. The above analysis of scientific time fits in exactly with the position which our own critical analysis forced us to take. The universality of scientific time follows from the identity of the reference made. We may say that the whole physical world is in *one* time: when properly analyzed, this only means that the same, identical process can be brought into relation with all the physical processes which we know.* Hence, the oneness of the world's time is expressive of the fact that all processes in nature can be compared and measured by human ingenuity. The world is spatially one, and so it lends itself to these comparisons.

An interesting result, which we might otherwise have missed, now stares us in the face. The unity of scientific time really rests upon the spatial unity of the physical world. The processes of change which are measured are changes in the physical world, localizable with respect to each other. We move our eyes hither and thither to note the changes which are running their course and keep tab of them in the light of the movements on the clock's face. It is obvious that the unity of scientific time implies the spatial character of nature. These two fundamental, and yet elementary, quantities hold of the same world. The elements of the two quantities are, however, essentially different. Space signifies order of coexistence in distance: its character comes out best in the experience of solidity. The idea of change is alien to its content. When we think of nature in terms of it, we think of coexistent bodies whose parts exist alongside of one another. Time, on the other hand, signifies an order of change qualified by duration. Such change we think of as *in* bodies. The distinctness of the two categories can be brought out in this fashion: Conceive of the physical world as inert and changeless. Would

* The modern theory of relativity deals with the assumptions underlying measurement. It has led to an analysis of scientific space and time long needed

time have any meaning for such a world? But our world is different. It is both spatial and temporal. Only when we think of it in terms of both do we grasp it properly. Thus they are co-valid of nature. Physics recognizes this correlation in the acceptance of the four-dimensional manifold of space-time.

Temporal Distinctions.—Let us next glance at certain distinctions characteristic of personal time in order to see whether we should carry them over to time as a category of scientific knowledge about nature. I refer to the time-meanings, the past, the present and the future. In personal time we distinguish the now from the past and the not-yet. It will be remembered that in perceptual space we distinguish the here from the there, chiefly with reference to the organism. What becomes of the temporal contrasts at other levels?

The present of common time is more a construction of arbitrary limits. It may be a minute, a day, a year, according to the context and interest. This relative character of the present holds also for mathematical time, for in it there is nothing to distinguish one moment from another except their order. The present of such a time is an arbitrary portion of time-room which can be made as small or as large as desired. There is no present in its own right in mathematical time. The situation is analogous to the arbitrariness of any "here" in mathematical space.

But what shall we say of the present for kinetic, or scientific, time? Does our knowledge of nature reveal a present which stands out in an absolute sense and can be measured? Obviously not. What science offers us consists of processes which can be correlated with the accepted time-intervals. Theoretically, such an interval can be made smaller and smaller; practically, this process of comminu-

[9] We shall examine the question of continuity elsewhere.

tion has a limit set by technique. The general measurements which are obtained in science give quantities which can be treated as infinitely divisible. Whether the natural process itself is of this type remains, however, to be seen.' The preliminary knowledge which gross measurement contributes is incapable of answering such a penetrative question. Be that as it may, it follows that kinetic time offers no natural present in any way analogous to the specious present of consciousness. Let us not, however, condemn science for giving only the sort of knowledge it can obtain.

Change the Objective Basis of Scientific Time.—If time be an order, it must be an order of something. In our own consciousness, it is an order of experience. What do we think of as in an order of succession in nature? The answer which leaps to our minds is change. Real time is change, or, to put it the other way around, change, as cognitively conceived, always involves an order of succession.

But the character of real change is, itself, a problem. Is change continuous or discontinuous? Again, does change involve an order in nature? We must postpone the detailed consideration of these questions to another chapter, but certain points may be noted now. In the first place, change in consciousness seems to involve both continuity and discontinuity. There is often no preparation for what happens. Thunder breaks in upon silence in a cataclysmic way. The principle of the threshold, likewise, suggests abrupt transitions. But it may be retorted that the nervous system carries the increasing strain cumulatively. To this it may be replied that there are different rates of change, and that nature often works like a gasoline engine by a series of quick explosions. At other times, change seems to be progressive and continuous.

When we ask ourselves whether change involves an

order of time, the answer seems clear. Change in consciousness does so, for that is the exemplar from which the category of time is derived. But when we think of changes in systems independent of consciousness, a difficulty arises. The past ceases to exist, and there seems to be no natural present. Knowledge about nature is not the same as nature, and we have a right to expect a divergence between the form of knowledge and reality. Let me illustrate the point. The scientist furnishes us with knowledge about a motion by describing the *path* traversed and the time-rate of the motion. But the body moving does not carry its path with it. Only man with his memory is able to connect a past position with a present one. The moving body has no such coordinating memory. When this difference is once grasped, we realize that knowledge about a motion is not the same as the actual motion. Paradoxical as it may sound at first, we must admit that nature produces events *according to an order* and that man arranges them *in an order*. The .stretched-out order of past and present is founded upon nature and agrees with nature but does not exist in nature. Knowledge and reality are not identical.

The "now" is present experience in contrast to past experience, which is remembered, and future experience which is anticipated. The remembering and the anticipating are present, while what is remembered is dated as past and what is anticipated dated as future. A little care would avoid all difficulty here. We should say that events are past rather than in the past. What we mean is, that certain processes or activities have ceased, though they once did occur. Their existence was their presentness. The "now" of nature is what is going on there.

It follows that temporal contrasts should not be read too naively into nature. When we come to consider the category of causality, the importance of this warning will appear in all its force. Can the cause, which is past, pro-

duce the effect which is present? Our analysis of time will enable us to meet such questions with assurance.

Real time is change: but what is change? Does it imply activity? Consciousness is a stream whose content is changing, that is, old content lapsing and new content coming. It is not a *thing* which changes so much as a series of changes. But when we think of the physical world, we conceive of it as *that which* changes or in which changes occur and not as a series of changes. If we can master a metaphor, we can say that "nowness" of nature is the reality of the things of which it is composed. In our thought of reality, we get rid of that threat of transiency which qualifies consciousness and gives much of its sadness to the present moment. It is evident that we are here on the track of the category of substance, of that which is the seat, source and center of change but whose existence is not imperiled by change. It is reality which changes and at the same time persists.

A Return to Kant's Antinomy.—To those who have grasped the implications of the above analysis, it will be clear that the usual view has been reversed. Instead of nature being in time, time (change) is in nature. So understood, time suggests neither beginning nor end to the world.

Had the world a beginning? We do not ask whether it had a beginning in time. Now, if the world had a beginning, it must have been because it was created, or because it arose out of nothing. But is there any good empirical reason which suggests creation? Is not the burden of proof on those who assert it? Science possesses no data which lead in that direction. To those who protest that they are forced to think of a beginning, it may be pointed out that they concede that God is eternal. It is evident that the thought of an eternally existing reality is a

common possession. Let us pass to the other alternative While I can't absolutely disprove that the world arose out of nothing, I find the idea opposed to all the tendencies of my thought which urge me to seek a cause for what comes to be. We are here face to face with the so-called problem of being.[10] As James has so well said, "Not only that *anything* should be, but that *this* very thing should be, is mysterious! Philosophy stares, but brings no reasoned solution, for from nothing to being there is no logical bridge."[11] But philosophy is essentially an attempt to understand the world as it exists. And, besides, not-being is a concept founded upon being by negation.

The complementary problem—Is the physical world eternal?—can be discussed in a few words. The position taken toward the previous question implies the answer to this one. The facts are in favor of conservation of some kind. What it is that is conserved is another matter and will demand consideration later. If the universe be a spatial system, what holds of subsystems can be applied to reality as a whole. The more science secures data in favor of conservation, the more it urges on us the view that nature is eternal. And by eternal I mean, not changeless, but never ceasing to exist.

Summary and Suggestions.—In the previous discussion on Space, we were led to the conclusion that spatial judgments are valid of nature and that the elements of the spatial category, such as distance, position and order, correspond to, and reveal, the structural character of the world. But we also realized that these elements appeared in those innumerable detailed judgments which constitute science. It was their commonness which constituted space a genuine category of knowledge. What is true of space

[10] Cf. Schopenhauer, *The World as Will and Representation*, Appendix 17.

[11] James, *Some Problems of Philosophy*, p. 39.

is also true of time. Temporal order and measurements give us knowledge about nature. Yet these categories require development and deepening: they are apt to be conceived in too passive and mathematical a form. While space blossoms out, with the increase of knowledge, into the categories of dynamic relation and internal organization, time deepens into the idea of processes of caused change. Dynamic elements enter to give body and energy to our concept of nature. Into the framework furnished by space and time all the other categories fit. No valid predicate can conflict with them. Reality is spatial, and this spatial reality changes.

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THE PSYCHOLOGY OF RIBOT AND CONTEMPORARY THOUGHT.*

THE conditions of speculation that had become established by French thought for two centuries were completely overthrown by the events of 1789 and the social revolutions and political upheavals which took place in the nineteenth century. Instability and *malaise* are such important factors that the groups in power are compelled to dread the temporary character of scientific truth and to enlist philosophers in defense of the beliefs to which they owe their cohesion. To eclecticism first, and then, under the July Monarchy, to spiritualism, they set the task of confronting free research with thoughts placed in the service of social truths. There comes into existence an esthetic doctrine of feeling which flatters the secret needs of the inner life, captivates attention and prevents due apprehension of the full scope of the scientific movement. After the tempestuous days of July, this doctrine denounces the tendential, provocative and revolutionary character of positivism, against which it pronounces sentence of exclusion, the surest effect of which is to discredit the work of biologists, positivists and the critical school, and to hand over opinion, in a defenseless condition, to the action of Anglo-Saxon ferments. Now, in England and Germany, where science is mainly of a technical and utilitarian nature, scientific evolution has not aroused the effort of critical reflection which is one of the fundamental tenden-

* Authorized translation from the *Revue de métaphysique et de morale* for Nov.-Dec., 1919 (XXVI, 6, pp. 739-763) by Fred Rothwell.

cies of French philosophy; it has merely brought to birth a new emotion. Urged on by collective disciplines and needs, speculation becomes enfevered and the rhythm of thought is accelerated; the study of life, civilizations, languages, peoples, religions, customs, literature and art has revealed the incessant becoming which moves beneath beings and institutions and which the stereotyped processes of the intellect are powerless to hold and to stabilize. To obtain the mastery, there is needed the combination of two hostile powers: feeling and a more uncompromising science. At the cost of a reconciliation, wherein we see a degeneration of science and artistic sensibility, which have both become impoverished, there arise such metaphysical systems as those of Schelling, Hegel and Spencer. Widely known in France, they bring about a philosophic diversion and give thought a fresh orientation, a new conception of human experience which sets free the passional elements of our nature and the blind forces of the world.

It was in such an atmosphere that the personality of Ribot was moulded.

I. RIBOT AND HIS WORK.

An easy, mobile and somewhat dreamy sensibility, hostile to constraint of every kind; a gift of comprehension and assimilation, along with a natural *finesse*: all these make Ribot peculiarly susceptible to the influences of the period in which he lived. Enamored of the spirit of truth, he desires to know the essence of things; all the same, he received from the vague teaching of his masters—where we see naturalism working along with the dynamism of Leibniz and Maine de Biran—neither the scientific mind nor the discipline which reveal to the young man the world of ideas, and rouse in him that intellectual emotion without which there can be no profound attachment to truth. Besides, in himself he possesses too keen a sense of the con-

crete, of the complexity of the real, of the true quality of beings and things, not to be speedily convinced of the poverty of logical measures, not to distrust thought itself. On the other hand, his impressionability and the measured character of his imagination do not allow him to find motives of uneasiness in inner meditation, to see in passionate outbursts more than a temporary alienation of the person, or to seek in his dealings with men and the daily intercourse of life for the elements of a moral or plastic creation. To him, being seems to bear within itself only a false and deceptive power. And Ribot, who secretly despises unactual considerations, is instinctively carried out of himself and feels drawn toward the philosophic, human or artistic works of his age. These he studies with a sympathetic curiosity sufficiently mistress of itself for no play of metamorphosis to distort their proportions and contour; and sufficiently plastic to discover, beyond the concatenations, the dialectical oppositions and the technical modes of expression, the emotion that animates them. He tends only to find his own particular tendencies in the study of contemporary tendencies; he tends only to acquire directions. The critical consciousness of modern sensibility becomes the first moment of a capture of self-consciousness. Still, however immediate they appear, the paths of feeling are frequently but the more tardy and uncertain. Ribot is so ready to grasp detail that he finds some difficulty in withdrawing from the diversion of impressions; his critical proceedings have long betrayed a kind of timidity, a defect of intellectual assurance, so to speak. Like Stendhal, he attained to complete self-possession only at a very late period of his life, when he was about forty years of age.

First we see him yielding to the fashions of the time, his infatuation for English thought which openly breaks with positivism[1] and secretly accepts the Biranian spiritual-

[1] *La psychologie anglaise contemporaine* (1870), pp. 100-103 and p. 244.

ism of the "School." In Stuart Mill and Spencer, Ribot finds again the same concern for the concrete man, the same freedom of investigation, the same latent metaphysics, the same sense of life in which the contrast is brought out with the little he yet knows of French thought, the traditions of the "School." He forgets that in them may be found the survival of the discipline which insures the perennity of the work of the ideologists and of Auguste Comte, the survival of the mental habits to which the opposition of eclecticism to science prevents their precise signification from being restored. Above all, he sees that there is being effected a seizure upon the intellect, which the Restoration, the Monarchy of July, and even to a greater degree the Second Empire have converted into too docile an instrument of power. From the year 1870, in the *Psychologie anglaise contemporaine,* he reacts less against French thought than against the Imperial University, at all events as much against a meanness and a servility which shock the conscience of a Vacherot, a Taine or a Renouvier as against the formal and metaphysical tendencies of instruction.[2] A work of political quite as much as of philosophical polemics, and even more so, the *Psychologie anglaise,* in which reasons of feeling outweigh those of logic, contrasts the obligatory moralism of the Empire as well as the authoritative dogmatism of Comte with the free criticism of the English, who, guardians of the tradition of all great scientific minds, have succeeded in safeguarding that "freedom of investigation without which there is no philosophic mind." Following their example, he desires to maintain in us our integrity of character and the free play of the critical faculties. At the same time, Ribot contrasts the forces of the past with those of the present; he distinctly proclaims the irremediable disrepute of meta-

[2] Cf. Ribot's article "M. Taine et sa psychologie" in *Revue philosophique,* 1877, p. 25, and Renouvier's *Essais de critique générale,* 2d Essay, "Traité de psychologie rationnelle," 1912 edition, Vol. I, p. 156.

physics, the coming of a scientific era and the liberation of psychology. In him is concentrated the entire secret work of the Second Empire. His simple, unstudied and direct exposition renders these new truths accessible to all who remain outside the operations of the school, the subtilties of logic and the refinements of culture; and who value scientific knowledge according to the practical facilities it provides. Thus there comes about the *annonciation* of a mental revolution.

But this reaction against a form of thought that sprang from the eclecticism of Cousin and holds sway in Latin countries is inadequate; it risks being ineffective if the materials of psychology continue to be wanting. All the works undertaken by Ribot during a period of ten years: on Hartley, on heredity, on Schopenhauer's philosophy and Taine's psychology, on contemporary German psychology, his translation of Spencer's *Principles of Psychology* in collaboration with Espinas, the lucid criticism of which determines the essential traits of the biological movement and of experimental psychology in Italy, the foundation of the *Revue philosophique* in 1876—all have one and the same end in view: to bring before the French public a new way of dealing with the phenomena of consciousness, to place at their disposal the effective instruments of Anglo-Saxon thought, and to spread broadcast the results obtained. This vast preliminary survey, comprising the work of Stuart Mill, Spencer, Bain, Herbart, Wundt, Lazarus and Steinthal, and Horwicz, shows how numerous are his attempts at a revival of psychology. The study of animals, human physiology and pathology, the study of languages and civilizations, have made it possible to set up new branches which are assigned to descriptive psychology: comparative psychology, morbid psychology, evolutionary psychology, the study of character. The English school, rich in *ensemble* works, is still mainly systematic and

Will and as Idea, gives direction to his investigations. The dull effort of feeling chooses the elements of crystallization from among the tendencies of contemporary psychology and biology. Ribot thinks less of making a thorough examination of the study of mind than of undertaking the study of feeling, which is more in accordance with his inclinations. Now, contemporary schools, engrossed in questions of sensation, perception and imagination, have scarcely touched upon this study; in Spencer, Bain and Horwicz we hardly find anything but outlines, analyses and sugges tions; whereas Taine's historical labors prevented him from giving to the *Emotions and the Will* the close investigation which his book *On the Intellect* demanded. It is in Schopenhauer's attempt to reach, beyond the abstract mind and the empty forms of thought, a concrete reality constitutive of the individual, that Ribot finds fertile suggestions. Schopenhauer restores its autonomy to the psychology of feeling by giving to Bichat's classic distinction between organic life and animal life, as generally accepted in the nineteenth century (by Comte and Spencer, among others), an interpretation free from any intellectualistic preoccupation. Organic life, which is primitive though secondary to philosophers eager to place the specificity of the psychic in the higher forms of the mental life, becomes fundamental and preponderant to the metaphysician who desires to reach the very heart of being. Consequently, Ribot transposes this metaphysic of the Will into terms of positive thought and enters into possession of a working hypothesis the terms of which he asks biology to define.[1]

While the French school is flourishing, scientific circles begin to see that an anatomical knowledge of the brain affords no knowledge of cerebral functions; the theory of cerebral localizations, which has been substituted for phrenology, has been reduced to its right proportions; the recent

[1] *Philosophie de Schopenhauer* (1874), pp. 71-73.

discovery of the pneumo-gastric and of the great sympathetic as autonomous systems independent of the nervous system, the investigations of Claude Bernard on irritability and organic sensibility, the clinical and anatomic-pathological studies made possible by the work of Charles Robin in general anatomy and undertaken at the suggestion of Charcot, enable us to become better acquainted with organic life, its workings and its relations to mental life. Influenced by this scientific current, Ribot, who has an inductive mind, a taste for "factual detail, psychological curiosities, exceptions without which we cannot get to the root of things,"[8] and who has found in Taine's method a confirmation of this taste,[9] half separates himself from Spencer's ideological system of which he retains only the postulate according to which the principle of evolution springing from embryology and extending to the development of the species is applicable to mental life, along with the theory of mind as a function and a mechanism for adapting oneself to the outer world. But he dreads too much "the somewhat scanty clearness of Condillac and Destutt de Tracy" not to part company with Taine. He begins to study medical jurists and French alienists, and in the uninterrupted sequence of investigations into mental pathology undertaken by Pinel, Esquirol, Lélut, Moreau de Tours, Baillarger, Cerise, Longet, Duchenne de Boulogne, Durand de Gros and Brière de Boismont, he gives evidence of the method of the clinician, the positive spirit and an aversion from the systems which characterize the works of the ideologists. He then attains to the idea of his pathological method, and, without suspecting it, resumes

[8] *Philosophie anglaise*, pp. 249-250.

[9] Taine, Preface of *L'intelligence* (1870) and *Correspondance*, Vol. III (4th ed.), p. 253, letter to Jules Soury. "The novelty of my book consists in its being entirely made up of trifling facts, significant instances, individual observations, descriptions of atrophied or hypertrophied psychological functions." This method, common to Taine and Ribot, is also in a sense the one used by Destutt de Tracy. Cf. R. Lenoir, "Psychologie et logique de Destutt de Tracy," in *Revue philosophique*, December, 1917, p. 532.

connection with one of the most fruitful and one of the most misunderstood epochs of French thought. This contact, after a constant and profound study, brings about a reconciliation between his nature and the tendencies of his age.

Then only, when about forty years of age, within a period of thirty years during which the German school declines and becomes eclipsed by the prestige of the American school, Ribot brings his contribution to psychology in the form of monographs and memoranda dealing with special subjects. Circumstances, the necessities of instruction, the inevitable variations of thought, impel him by degrees to extend his domain, to pass from the lower to the higher functions, to pure psychology, to substitute for the pathological method originally employed in studies on memory, personality and will, a descriptive method more compatible with the study of attention, general ideas, feelings and the creative imagination. Still, it would not be quite correct to judge by the outer decisions of his thought in interpreting this modification as an implicit recognition of the barrenness and inadequacy of experimental psychology. In Ribot the transformation came about "slowly, involuntarily, almost without his being aware of it." It is nothing but an expansion of his nature. Remembering the profound influence that the *Maladies de la mémoire* had exercised over the minds of men and seeing an ever more fruitful school of mental pathology, Ribot's critics might have thought there would follow a rupture; they located his originality as being where exclusively it was not, as being in some technical process. Now, Ribot's method, though occasionally pathological, is *concrete* in its essence. Ribot indeed knew, as did Claude Bernard, that "the true method is that which holds in the mind without stifling it, and which, as far as possible, allows it to face itself; which guides it and at the same time respects its creative originality and the spontaneity of science: most precious qual-

ities." Like him, too, Ribot made a profound impression only because he did not doubt his own spontaneity and was able to establish a secret unity between his nature and his work. In every subject he investigates, he keeps close to the concrete individual. This sole aspiration insures the inner coherence of a work from which all logical unity appears to be absent, the life of a work whose immediate or distant reverberations have moulded European thought.

II. THE PSYCHOLOGY OF RIBOT.

Too long has psychology regarded consciousness through the forms of thought, used the analytical method, accepted abstract and formal appearances, and thus failed in its essential duty: to get at the concrete being, the real person.

Now, mental activity cannot be decomposed: the person forms a synthetic whole the apprehension of which eludes both analysis and an intuition of consciousness which lasts scarcely more than a few seconds. States of consciousness, discontinuous and always unstable, are raised up and supplant one another by a transmission or a conflict of forces of the nervous elements which produce them within the limits of the present.[10] If they are not "will-o'-the-wisps which alternately shine and die out," it is because there is something that unites them. This bond, which some have regarded as a transcendental entity and others as a form which keeps the sensations piled together, as it were, cannot be given by reflection, since the real personality does

[10] Ribot rightly insisted on the fact that the present alone is given in consciousness. Cf. *Evolution des idées générales* (1897), p. 181. "The present has the privilege of appearing before consciousness as the duration-type, the standard, the measure to which everything should be related: and it cannot be otherwise, since indeed (a thing too frequently forgotten) we live only in the present; the past and the future do not exist for us, are known by us only on condition they become present and occupy our present consciousness. The present is the only psychological element which, consciously or unconsciously, gives a content and a reality to duration. It is essential to rid oneself of the opinion, sanctioned by many authors, that the present is only an inapprehensible moment a transition, a passing, a flash, a mathematical point, a zero, a nothing: on the contrary, it is it alone that lasts, now for a long, now for a short period."

not assert itself by reflection, but by acts. "To grasp the real concrete personality and not some abstraction which takes its place, is not simply a matter of retiring into one's consciousness with closed eyes and obstinately questioning it: on the contrary, we must open our eyes and observe. The child, the peasant, the workman, the millions of people in street and field who have never heard mention of Fichte or of Maine de Biran, who have never read a single dissertation on the self and the not-self, nor even a single line of psychology, each have their own distinctive personality and instinctively affirm it every moment of their lives."[11] This instinctive affirmation dwells in the vague feeling of the body; the spontaneous, natural feeling of our self, present in every healthy individual, is the expression of the coordination and the consensus of the organism. "This coordination of the innumerable nervous activities of organic life is the basis of the physical and psychic personality, all other coordinations depend upon and are added to it; it is the interior man, the material form of his subjectivity, the final reason of his mode of acting and feeling, the source of his instincts, feelings and passions, and, as they said in the Middle Ages, his principle of individuation."[12] Consequently, the self in its simplest form is a coordination of psychological tendencies and states whose proximate cause must be sought in the concurrence of the vital energies. The continuity of the mental life arises from the continuity of the organic substratum underlying it; and the psychological expression of cœnesthesia is found in the character.[13]

If we now follow the order in which the psychological functions appear in specific evolution and in individual evolution, we find that they have their source in character. The pathological study of memory, will and personality

[11] *Maladies de la personnalité*, p. 88.

[12] *Ibid.*, p. 161.

[13] *Maladies de la volonté* (1882), p. 30.

at least establishes this irrefutably, and enables us to hit upon the law of dissolution. Thus, according as we quit purely organic states and pass from physical into affective, and from affective into intellectual states, we find that they express the totality of individual tendencies, then a smaller and smaller part of the individual tendencies, until the activity of the physical and that of the social environment almost completely take the place of that of the person. As psychological phenomena become more complex, their physiological importance decreases and their motor power diminishes. These preliminaries prove that the character is really at the starting-point of all psychic phenomena, whatever be their degree of complexity.

And so the psychologist's task is defined. Reversing the order followed by the intellectualistic psychologists, he must circumscribe the distinctive contribution of the person in the life of the mind, in contrast to the contribution from the outer world, and must determine its nature and modalities. No doubt the work is a complex one for we must take into account the intervention of factors that have appeared at different moments of evolution. The direct data of biology and the indirect data of pathology, however, prove that irritability, which is constitutive of the individual, develops along two parallel lines, motricity and sensibility, in which the whole of psychology will shortly subsist.

* * *

Since consciousness manifests itself in change, and change has its first condition in movement, movement shows itself as the fundamental condition of knowledge. Motor activity is at the very starting-point of mental life, and motor elements necessarily appear in the constitution of all our states of consciousness, either as bodily movements or as kinesthetic sensations or motor images. For not only are our movements accompanied by distinct specific sensa-

tions, links between the organic and the special sensations. but we also retain, within ourselves, images that represent movement, and we possess a motor memory which allows of the revival of the external movements themselves. For "if the motor apparatus had not its own memory, images or residua, no movement whatsoever could either be learned or become habitual."[14] Accordingly habits, motor manifestations, are included in tendencies, in the specific sensations of sight and hearing,[15] in ideas,[16] in the "dynamic" assocations which constitute the effective conditions of memory,[17] in the immediate associations resulting from a kind of irradiation of movement and in the mediate associations resulting from a kind of transmission of movement. Thus, in the various modes of knowledge, the motor element is seen to have its place as an intrinsic part of a complex whole.

Certain phases of the mind, such as doubt, surprise, conviction, astonishment, belief[18] and attention, which Ribot had investigated long before a psychology of attitudes had been constituted, seem to correspond to a particular mode of motor activity, devoid of matter and content, "an extrinsic means of support and resistance without which states of consciousness would remain a plastic and fluid matter." Thus, "motor activity permeates and envelops our psychic life and constitutes the solid part of it. Physiologically, it depends on the motor nervous system, both central and peripheral, acting in voluntary or spontaneous impulsions, and also on the sensitive nervous system which transmits the kinesthetic impressions to the cortical layer of the brain. Psychologically, in the form of presentations

[14] *Psychologie de l'attention* (1888), p. 78.

[15] *La vie inconsciente et les mouvements* (1914), p. 28.

[16] *Evolution des idées générales,* p. 147, and *Psychologie de l'attention,* pp. 75-86.

[17] *Maladies de la mémoire* (1881), pp. 50, 51, 163.

[18] *Essai sur l'imagination créatrice* (1900), p. 93.

and representations, it contributes toward the formation of each state of consciousness and toward their association; in a word, it constitutes those general and momentary inclinations that are called attitudes."[19]

Thus beneath our states of consciousness there remains a kinesthetic portion which we are unable to apprehend directly since it is our sensibility that reveals our inner states to us and this sensibility is not free from all elements of knowledge. These elements and these motor mechanisms, which are not accompanied by consciousness, are the skeleton, as it were, the permanent element which remains when the consciousness withdraws. In them lies the possibility of an unconscious motor activity, for motor phenomena possess an inherent tendency to organize and solidify. They have a latent role apart from their effective role. It may be that they constitute that "unconscious" of which so much has been said, with the desire to present either an intellectualistic interpretation of it, or else a mystical one, by appealing, now to a subconsciousness, now to a superconsciousness which, according to Myers and William James, would appear to constitute "a link between the human and the divine." If we accept a highly plausible physiological hypothesis, the unconscious acts simply after the fashion of an "accumulator of energy." In certain circumstances, the unconscious activity comes up into the foreground, takes the place of consciousness, annihilates the life directed toward the exterior world, and shows itself as a power alien to the individual. According to this interpretation, motor activity is at the root of all creation, of mechanical invention, art and religion.[20] It accounts for the phenomenon of inspiration which it strips of its element of mystery, since it results from a dual interversion of the normal state. If the fundamental mechanism of functions

[19] *La vie inconsciente et les mouvements*, p. 41.

[20] *Imagination créatrice*, Chap. iii.

like attention, the will, creation, which are connected with movement, eludes us, that is because there enter into consciousness only the two extremes, the beginning and the end, and all the rest takes place in the realm of physiology.

And so a subterranean life exists, a dynamic unconscious,[21] which is "a latent state of activity, of incubation and of elaboration," and which regards motor activity as the background of mental activity.

* * *

Among the various movements of the body, the organic, motor, vasomotor and muscular reactions are accompanied by a particular psychological equivalent, the affective state. Under whatever form[22] it offers itself and whatever degree of complexity it reaches, this is nothing else than the representation of organic sensibility, the direct and immediate expression of vegetative life; it has its cause in cœnesthesia. True, this interpretation, manifest for the purpose in view and long ago formulated by Spinoza in a less strictly scientific fashion, has but recently been extended to the lower emotions, the necessary manifestations of life, by Lange and James. It may be carried to the higher emotions; for, however complex the social and personal elements which combine in their formation, these modes of affective life could not dispense with an organic support. And Ribot, after examining, in their relations with organic life, the primary emotions—fear, the tender emotion, the selfish emotion, the sexual emotion—endeavors to show that the feelings, regarded in their concrete form at the very mo-

[21] *Logique des sentiments* (1905), p. 79. Ribot mostly shows himself very reserved on the question of the unconscious and refuses to declare himself categorically on "this inexplicable problem and the semblances of explanations" which have been given of it. He contents himself with distinguishing between two acceptations of the term unconscious: the *static* unconscious, "comprising habits, memory and in general all organized knowledge," and the *dynamic* unconscious. Cf. *La vie inconsciente*, p. 55, and *Psychologie des sentiments* (1896), pp. 173-175.

[22] On the classifications of affective life, to which Ribot attributes only a methodological value, see *Logique des sentiments*, pp. 24 and 67, and *Essai sur les passions* (1907), pp. 1-7.

ment they are felt and experienced, are accompanied by physiological conditions. Thus, the religious emotion is closely connected with the instinct of preservation; the moral and intellectual emotions with physical modifications and disturbances; the esthetic emotion with the excitation of sensorial elements, as demonstrated by the contemporary German school.[23] The passions themselves, which are prolonged and intellectualized emotions that have so far eluded analysis by reason of their very complexity, must have physiological — perhaps even pathological — conditions which Ribot endeavors to suggest in his *Essai sur les passions*. And so all the modalities of the affective life are attributed to the organic or vegetative life, to nutrition, to the life of relation, and, more generally, to the preservation and development of the individual. As Spinoza had already set forth in a famous scholion of his *Ethics* (III. Prop. 9, Schol.), and subsequently Schopenhauer, we find tendency beneath desire, beneath "will." And tendency is no more than "the possibility, which becomes a reality, of acting in a certain direction and with a determined end in view. The internal and external sensations, which incite it to pass from a state of potentiality to one of action, are but occasional causes. The fundamental phenomenon is still a motor one, i.e., appetition, sensation, attraction, repulsion."[24]

Tendency, however, has two fronts, one facing the unconscious, the other facing the consciousness and illumined by pleasure and pain. Beneath this latter front it becomes a new factor in the psychological life of the individual, a result which may serve as a starting-point for some new work, either conscious or unconscious. The conscious affective state seems endowed with spontaneity and with a finality of its own similar to that kind of internal finality invoked by biologists, for "the individual as a purely affective

[23] *Psychologie des sentiments*, I, Ch. viii. [24] *Essai sur les passions*, p. 55.

being aims at one object alone, the satisfaction of his desires; and in the individual each special tendency aims at its own special end and good."[25] In whatever form it be, the affective life permeates the mental life.

At first, the affective states become one with sensation and perception, which, like them, are of primary formation. Afterward, however, they occur in the functions of secondary formation, the conservation and revival of images, the interplay of images, elementary logical associations and operations. They also work with the intellect, a function of adaptation to the physical environment which contributes to the preservation of the individual and which has long retained the practical and utilitarian character it had at first. Later on, in the mental functions of tertiary formation, a distinct scission takes place between the affective life and the intellectual life, and their differentiation culminates in an opposition and an antagonism: on the one hand, the logical processes become cleansed of every element of feeling; on the other, we have the will and the creative imagination established. The world of knowledge and the interior world have won their autonomy and are each living a life of their own.

In a certain number of monographs Ribot describes some of the stages of the affective life; he is inclined to prefer those in which the interior life is seen in a state of comparative purity. Stating the principle of the existence of purely affective states and the secondary nature of pleasure and pain as different expressions of one and the same fundamental rhythm of life, he attempts to prove the existence of an affective memory.[26] He shows the interior life, which is naturally anarchical, divided between "states which mutually impede, exclude, destroy one another."[27]

[25] *Psychologie des sentiments*, p. 410.

[26] *Psychologie des sentiments*, I, Ch. xi, and *Problèmes de psychologie affective* (1900), Ch. ii.

[27] *Logique des sentiments*, p. 15.

But if some vital need arises, there is agreement between all the tendencies connected with the principle of conservation. Desires, aversions, beliefs become the starting-point of pragmatical reasonings, indifferent both to truth and to contradiction, and tending only to rationalize instinct. This *logic of the feelings*, from which rational logic has gradually disentangled itself owing to the control of experience, to the progress of technics, to an ever closer adaptation of reasoning to the nature of things, remains side by side with rational logic, even in modern times. The conditions of life which created it, maintain it in being. And not only is there a logic of the feelings, there is even, for the man who thinks, an instinctive mode of adapting oneself to things: *intuition*. "This state (considered as a simple psychic fact and independent of the metaphysical inductions that have been drawn from it) consists in feeling rather than in knowing. Analogous to a sensation rather than to a perception, intuition resembles a sudden and confused divination which baffles rationalism."[28] That direct form of apprehension, of spontaneous adjustment, which is included in feelings of sympathy, indeed seems to prove that logical thought is but one of the forms of knowledge.

Besides those kinds of survival which have eluded the domain of logical thought there are more complex states, such as the *creative imagination*. Creation has partially affective origins. "All invention takes for granted a need, a desire, a tendency, an unsatisfied impulse, frequently a very unpleasant state of gestation. In esthetic creation, we find the emotional factor at the outset as the prime mover, and afterward connected with the various phases of creation as their accompaniment. But affective states become more and more the material of creation."[29] There are functions that have but very tardily attained their

[28] *Psychologie affective*, pp. 100, 101, pp. 115-177, and note on pp. 115, 116, 117 (Judd's passage dealing with intuition).

[29] *Imagination créatrice*, p. 27.

development "and which presuppose the preponderance of the interior life in the sentimental form, i.e., a very rich substratum of various and complex emotions, qualified to form combinations, oppositions and contrasts of every kind." The *affective creative imagination* combines purely affective states, "emotional abstracts," which have become released from past feelings, by virtue of a mechanism analogous to that of abstraction and generalization. Living a life of their own, they group themselves to form partial systematizations. In reverie or impressionism we see outlined embryonic affective creations. In religious mysticism, where love is the first cause of invention, the affective creations are accompanied by a state of enduring belief. In the art of the symbolists, whose mechanism Ribot analyzes with considerable acumen though disclaiming all thought of criticism or capacity for worthy judgment, "sensation dies away in emotion and the artist invests things with his own affective color," "things are replaced by the emotion of things." The artist then has to struggle "against the obstacle of verbal expression which is ill suited to him, which impedes him, and, by an instinctive or deliberate effort, attempts to conceal his methods from the (musical) type form." Not so much interpreting the thought as the feeling, he confers on words, by various processes, an emotive value. But the affective creative imagination reaches its type form only in musical creation. No doubt, in its modes of expression, musical creation is subordinate to mechanical invention and also to scientific invention; in its nature it reflects an inner life which has no further contact whatsoever with the world of knowledge; and it was not without a certain amount of reason that Schelling, Hegel and Schopenhauer regarded music as a liberation. Thus we have revealed the struggle of creative imagination to attain its independence, to free itself progressively from objective conditions until the time comes when emotion,

living its own distinctive life, obtains the mastery over the individual, or else spreads out over things, expands and becomes a kind of absolute.[30]

There is still, however, in the order of action, a state characterized by the preponderance of the inner life in the form of hierarchical coordination, already sketched in the phenomenon of spontaneous attention where interest and the play of tendencies determine our attitude: a state which consists of the voluntary act. A reaction peculiar to the individual, "adapted to very complex, very variable and very impermanent conditions, differing from one individual to another and from one moment to another in the same individual," volition presupposes the intervention of intellectual activity.[31] Considered, however, as a simple state of consciousness, it is a phenomenon of choice which amounts to the establishment of a relation of agreement between one tendency or several contradictory tendencies with the totality of the conscious, subconscious and unconscious states which at that very moment make up the person, the self. "The choice is always based on an affinity, an analogy of nature, an adaptation."[32] As a stage toward action, therefore, volition sets up a balance between present tendencies and permits of an orientation of the action which may be in conformity with our character and which may cause to translate itself into action that one of our tendencies which shows the greatest affinity with it. For the final reason of the choice lies in the character. And so, contrary to the opinion of the intellectualists who regard the volun-

[30] *Imagination créatrice*, III, Ch. ii. Cf. *Logique des sentiments*, Ch. iv, and *Psychologie des sentiments*, II, Ch. x.

[31] *Maladies de la volonté*, p. 26. "Intelligence being a correspondence, a continual adjusting of internal to external relations, and, in its highest form, a perfectly coordinate adjustment, the coordination of these states of consciousness implies that one of the movements which expresses them. When an object is chosen, it acts after the fashion of what the metaphysicians call a final cause: it carries with it the choice of the means adapted to attain to it. Consequently, adaptation is one result of the mechanism of mind."

[32] *Ibid.*, p. 27.

tary phenomenon as absolutely new and as the manifestation of a metaphysical principle of liberty, the will comes from below. "Volition is not an event coming from no one knows where; it drives its roots into the depths of the unconscious and beyond the individual into the species and the race. It comes not from above, but from below: it is a sublimation of the lower elements."[33] The study of mental diseases shows that its fluctuations and changes for the worse closely depend not only on the weakening of the motor power but also on the changes for the worse experienced by the personality. It is an affirmation, a hierarchical coordination which presupposes the momentary unity of the inner life, for "the outer unity of life is itself but the expression of the inner unity." It is a state in which ideas are placed at the service of passion, an increasingly complex coordination of tendencies. In consequence it contrasts with the normal conditions of the affective consciousness which presupposes perpetual change and discontinuity; in consequence it takes place very seldom, a sort of "lucky accident." Only from time to time does the individual free himself from automatism, from the habits, passions and imitations in which he is imprisoned, and in an act expresses complete adaptation to the inner conditions of life. The voluntary act is the one which best reflects the character and is the most perfect expression of the constitution and organism of the person.

Thus we find indicated the fundamental place held by the organism, the person and the character. In the order of action and in that of knowledge, in both the lower and the higher functions, we invariably find the element of the self in so far as it reacts, "an extremely complex product which heredity, physiological circumstances both before and after birth, education and experience have contributed

[33] *Maladies de la volonté*, p. 150.

to form."[34] To be complete, therefore, we must here reinstate the effects of civilization. Alongside of the depths of the individual self we find the social self. But Ribot, who in another connection recognizes the specificity of the social,[35] includes it in his studies—and that for the very reason of their biological trend—only as a secondary element, and contents himself with summarily indicating its role in the formation of the character, the constitution of the higher feelings, and the constitution of the voluntary attention which is no more than a "sociological phenomenon." The evolution of the mental faculties shows that the inner life is alike their origin and their goal. The inner world more and more completely adapts itself to outer environments for the needs of active life, knowledge is established and gradually the impersonal elements become weakened, the initial provocative conditions of action become simple technical means and fade away before a complete and unconditional affirmation, a free expansion of the inner life. The being is no longer satisfied with giving a personal stamp to its activity. It must still obey the suggestions of imaginary life and express a sort of absolute reality in which the self is reabsorbed, mystical ecstasy or musical creation.

III. RIBOT AND CONTEMPORARY THOUGHT.

Thus, if we release Ribot's work from the secondary problems and the hypotheses, the justifications of detail, the accessory aspects which constitute its purely technical part,

[34] *Maladies de la volonté*, p. 30.

[35] In Ribot we find a latent sociology even though he did not always clearly distinguish the arguments which affirm, from those which deny the specificity of the social, and showed too great confidence in Tarde's occasionally fantastic results. In *Psychologie des sentiments* (II, Ch. viii), however, dealing with moral and social feelings, he admits the existence of a tendency to live in society, the existence of a clan as one type of society, a social molecule, the existence of a gregarious society to which, along with Durkheim and in opposition to Espinas, he subordinates the family society. The specificity of the social is thus, to him, an idea in a germinal state. He distinguishes between animal and human societies and proves that the social tendency, which is their starting-point, is one product of the conditions of existence.

this appears to be its essential nature: a study of the inner life in its divers manifestations, scientific both in purpose and in fact, though involved in a latent metaphysics. Ribot has extracted from the inner life, which becomes the more fixed and abundant the more we pass from the lower to the higher forms, a working hypothesis that eludes criticism. In doing this, he disturbs the balance of psychological studies at a time when music is entering into the manners of the age, when symbolism is being contrasted with naturalism and color being substituted for design in the plastic arts. Certain aspects of his investigations may connect him with Destutt de Tracy, with Cabanis, with Laromiguière, with Maine de Biran and with Stendhal; all the same he indicates a new phase which it may be advisable for us to regard as the intervention of a period quite as much as the intervention of a mind. Before Ribot, the French psychologists had investigated the relations between organic and mental life and had determined, so far as the resources of biological science at that time permitted, the part played by organic inclinations in the whole of the mental life. Destutt de Tracy in his *Eléments d'idéologie* and his *Théorie de la volonté*, Cabanis in his *Rapports du physique et du moral de l'homme*, Maine de Biran in his dissertations on *Habitude* and on the *Décomposition de la pensée*, and Stendhal throughout his works, had all made a thorough examination of motility, sensibility and passion.[36] The scientific habits of their age, however, had instilled in them a concern for a precise and exact terminology. They undertook a critical examination of concepts. Their pre-

[36] Cabanis has already remarked in his *Rapports du physique et du moral de l'homme* (ed. 1824, 10th Mem., Vol. III, pp. 145, 146), that the analyst philosophers, from Condillac onward, remember only the impressions that come from without, to the detriment of internal impressions. Cf. *op. cit.*, 2d Mem., pp. 56, 93, § IV, § V, and *Premières déterminations de la sensibilité*.

On Maine de Biran see the learned studies of Victor Delbos in *Figures et doctrines de philosophes* (1918), and *Philosophie française* (1919); on Stendhal, the work of H. Delacroix, *Psychologie de Stendhal* (1919). On Destutt de Tracy, my own essay: "Psychologie et logique de Destutt de Tracy" in the *Revue philosophique*, December, 1917.

cautions, their verbal exactitude — which our contemporaries, obeying their intuition, regarded as nothing more than obscurity and barrenness—become all the more pronounced in proportion as the states of consciousness examined become more uncertain and less strictly determined; into the unconscious and the subconscious they mean to flash the light of intelligence. They are deeply attached to science, the working of the mind, the higher forms of mental activity. And so, whatever importance they attach to sensibility, they regard both the organic and the affective life as distinct from conscious life; in the order of time, they are primitive; in the order of values, they have but a secondary importance. Ribot, on the other hand, looks upon the notion of affective life as fundamental in the order of values.

Then a process of irradiation interrupts the dissociation of the concepts used in psychology. Since the principal distinction set up by Maine de Biran between "feeling" and the fact of "feeling oneself cognizant" disappears, the concept of consciousness grows dim, takes on a new meaning and becomes identified with the concept of sensibility. The concept of sensibility itself simultaneously covers organic manifestations and certain modalities of conscious life, thus confusing the biological acceptation and the usual psychological one. On the other hand, the concept of intelligence becomes void of all positive content. Thus Ribot cannot free himself from the limitations he originally imposed on his investigations, in a natural feeling of reaction against intellectualistic psychology. As emotion extends and permeates every aspect of conscious life, it becomes impossible for him to see distinctly the function of the mind: the uniting and concentrating of the life within us and the insuring of a communion and participation among men in higher forms of reality which do not recognize the individual as such and break up the narrow circle of instincts and

desires. Following in this the example given by Taine, he substitutes for function an abstract logical mechanism and then, if the latter is unproductive, he expresses astonishment.[87]

Hence the method which Ribot thinks evolutive is only retrogressive. Passing suddenly from the evolved forms of mental life to what we suppose to be primitive forms, and then combining these elements to attain to concrete reality, we remain the victims of verbal constructions that have no scientific character whatsoever. The state of "the primitive man" as described by Spencer and the English anthropologists, the likelihood of an original fusion between sensibility and intelligence, cannot be made arguments which entitle us to rob logical life of its own distinctive value and of the preeminence it has won in the course of mental evolution. However great the distinction between inferior societies and modern societies, sociological labors do not show that feeling is anterior to logic; they only prove the simultaneity of the two.[88] Speculation, too, which ventures beyond these observations, is powerless to explain the transition from animality to humanity, unless it simplifies the question extremely and regards idea as no more than a degradation of tendency. However it be, the identification of consciousness with the immediate feeling we have of ourselves and an ambiguous study of sensibility which is not counterbalanced by a parallel study of intelligence, may help to curb English associationism by the introduction of a dynamic point of view and introduce some clearness into the psychology of movements.

[87] Cf. *Evolution des idées générales.* On many points, Ribot would seem to have found a precursor in Taine. Cf. "M. Taine et sa psychologie" in *Revue philosophique,* 1877, p. 23. Like the latter, Ribot wholly accepts the results of ideological analysis concerning the mechanism of intelligence reduced to *abstraction* and *generalisation.* This formal explanation then enables idea to be volatilized, as it were, and concept—whose social nature is thus disregarded—to be reduced to a simple motor scheme.

[88] Cf. Lévy-Bruhl, *Les fonctions mentales dans les sociétés inférieures,* I, Ch. ii, especially p. 113.

This, however, is at the cost of a certain obscuring of general psychology. And Ribot would seem to be undoing piecemeal the work of Auguste Comte and of Renouvier.

* * *

After this intrinsic examination, it is perhaps advisable to consider Ribot's work as it manifests itself.

His intellectual probity and clarity of exposition, his documentary wealth and largeness of view have won for Ribot a degree of legitimate authority both in France and abroad. After first concentrating attention on a domain totally new to generations brought up in the ignorance of the eighteenth century, he brought together the scattered efforts of alienists, doctors and physiologists, formulated problems, showed that clinical studies were a means and not an end, and supplied a technique and working hypotheses. In this respect, his efforts bear a certain analogy with those of Claude Bernard. Like this latter, he neglected ready-made science in order to consider more especially science in the making. Like him also, he attacked the scientific circles even more than the philosophers. His earlier works on the *Diseases of Memory, Personality and Will* have given birth to a school which has taken up the study of somnambulism, hysteria, psychasthenia, dual personality and mental alienation with the object of placing mental pathology on a firm basis.[39]

The pathological investigations, however, of which Ribot was the initiator, and which, as he readily acknowledged, characterized the school of French psychology, were in his mind and work only at the moment of his investigation. Sufficiently acute, even sufficiently artistic, not to limit sensible manifestations to organic manifestations alone, his criticism of symbolism and his excellent ideas

[39] Cf. Pierre Janet in the fine homage he pays to the "Œuvre psychologique de Ribot," *Journal de psychologie normale et pathologique*, July-August, 1915, pp. 276-279.

react, is but a philosophy of modern English industry and its technical innovations in which may be revealed a trans formation in the economic estimate of intellectual values. a transformation which carries with it the momentary depreciation of intellectual life.

Now, events appear to be accelerating this struggle in which the future of civilization is at stake. From 1914 to 1919 human experience has been enriched by silent meditation born of human suffering, and we have discovered that a thought is judged by its power of expansion, its organizing value, its sufficiency from the human standpoint. We have learned that science, disinterested speculation, the forms of unactual thought, are mainly important owing to their ethical character. We are at the outset of a transformation in the moral estimate of human values, where types of humanity, instead of neutralizing one another, are opposed to one another. Perhaps we shall go so far as to seek in a sort of meditation, in looking back upon our civilization, for a truth by which we may be able to live and which expresses a profound agreement between ideas and morals. We shall then find in the very essence of French thought, in humanism, a wide and all-embracing inspiration, which will enable us to follow the tendency of modern societies toward an uncertain future, without sacrificing any of the requirements present at every moment of our history—requirements sufficiently complex to demand the mediation of thought, sufficiently vital for all speculation to be vain which does not first insure to them inner balance and social harmony. Then, fronting a state of chaos, France will uphold the rights and dignity of thought.

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LOGICAL FICTIONS.

III.

We have seen that the external world is known to us through patterns which appeal to us, as it were, by their flavor through our senses. We have to concentrate on selected bits of experience. And these bits are subjective in the sense that their form depends entirely on the nature of our comprehension, just as a drop separated from the ocean depends for its form on the "comprehension" of the atmosphere. We have also seen that, for practical purposes, this primary comprehension through the senses seems to be immediately modified by what we have called an explanation, the function of which is to satisfy, rather than to "explain" in the ordinary sense of that word. For instance, most of us are content to explain sounds by saying *where* they are, which does not say *what* they are. If, as was suggested, this satisfaction depends on the fufilment of expectations, it is important to see exactly how these expectations are formed. It is, of course, undeniable that many of our expectations are due, very largely, to emotions and passions. Even philosophers and scientists sometimes see only what they desire to see. But, however great may be the influence of emotion, we are not free, so long as we are sane, to see anything we fancy. The man in the moon is a fiction: the moon is a logical fiction. And it is the purpose of this chapter to explain the difference.

Most people would admit that there is something fictitious in "the space between two trees." A child can recognize such a thing: but if I sold it to you, it might tax the ingenuity of lawyers to decide what it was you bought. It is not hard to convince oneself that although it is easy to talk of a space between two trees, easy to "see" it, it is impossible to deal with it unless we take into consideration its limits. But it is clear that the limits themselves require to be limited before we can deal with them. A tree is a vague term which cannot serve as a clear limit, for it is as undefined as the space until we name the limits: and this can be done only by naming other limits, which also have to be defined by naming limits. Hence it is clear that when we speak of a thing, we are dealing with what may be obvious to a child (that is, what we have called the pattern); but this obvious thing depends entirely on definition, which is what we have called the explanation. Such obvious patterns as "life" and "death" are inconceivable apart from circumstances. If we keep clearly in mind that words not only are symbols for patterns, but also, *insofar as they have any meaning,* imply the defining circumstances as well, we shall see how it is that we can work so accurately and satisfactorily with what seem at first sight to be mere imaginations. It is true, in a sense, that the external world, as we know it, is a construction of our mind and exists, as such, only in us. But any statement we choose to make, provided that we can define the limits, may be true within those limits. We have seen that theoretically it is impossible to limit the limits: the process has no end. But in practice we can fix an arbitrary limit: we can (and must) afford to ignore the infinite remainder. Hence truth is always relative, but for practical purposes relative truth may be treated as if it were absolutely true. This is clearly a fiction, but it is as logical and useful and correct as the

differential calculus. We now have to consider what it is that makes a "logical fiction" logical.

We shall deal in a later chapter with words in combination, that is, the symbol, or expression, of a sentence. At present we are concerned only with one element of such a sentence, namely, such symbols as dog, doom, death, darkness and similar words. We have seen that children can use them: and that any fool can tell, for instance, what is darkness, but only a fool thinks he can say what darkness is. Now it is quite conceivable that a child might recognize one dog, but not two dogs: it might call one of the two a wolf. Thus what you would call two dogs, the child might call a dog and a wolf. Further knowledge, we say, will lead the child to call them two dogs. What is this "further knowledge"? We shall answer this more easily if we work backward. Before a child could say "That's a dog," it may have been able to say that's a "big one" or "a lovely one" or "an ugly one." In other words, we can imagine it being concerned with "ones" qualified by an epithet. Even when we grow up we always think in this way, though we abbreviate. "One" here means an instance of: it is the pattern. That is ONE, we think; we then add the adjective: that is a *lovely* one, that is a *doggy* one. Hence it seems that the obvious pattern we spoke of is really ONE, and the limits or circumstances really epithets. Every *thing* may be first thought of as ONE and then as a *thingy* one. I find it hard to say which of these two is the more astounding performance. For let it not be supposed that ONE is simple. When we are dealing with a dog, the difficulty of seeing the oneness is probably as great as the difficulty of seeing the dogginess. For here again, we are baffled by limits that do not end. For "one" is only an instance of oneness; and as we can none of us remember our efforts in very early childhood, it is extraordinarily difficult to imagine how the faculty is developed; but there can be no doubt that, speaking gen-

erally and roughly, during those early weeks an instinctive desire for rest and for a feeling of safety drives us to concentrate our attention on the more permanent aspects and obvious portions of our perplexing surroundings. It is highly probable that most of our early ONES are unsuccessful constructions; it is certain that many of them are. But however far we go back, it is impossible to imagine any time at which ONE could ever mean anything at all unless at the same time we had some notion as to what kind of a one it was. In other words, it seems impossible to think of any "one" without the explanation that satisfies. It seems, then, that we must answer the question as to the child's increasing knowledge which will lead from "one dog and one wolf" to the correct "two dogs," by saying that the child has got the oneness—there is no doubt that the animal is *one*, whether you call it a dog or a wolf—but that its epithet, its analysis of the circumstances, its idea of the duties to be expected, differs from yours. In other words, the child's taste differs from yours.

It has been said, in fact it is usually taken for granted that about taste there can be no dispute. That is a preposterous assumption. Taste is the sole argument of all dispute. You admit perhaps that if I say "That is lovely" and you say "That is ugly," it is waste of time to argue. And yet if I say "That's a dog" and you say "That's a cat," ten to one you'll think that it is a matter of fact and by no means a matter of taste. Why? Because you assume in the second case that our taste in natural history is the generally accepted and orthodox taste, which, if once admitted, makes it impossible to mistake a cat for a dog; whereas in matters of esthetics, you are quite ready to believe that the circumstances, the limits, the relativity of my taste differs from yours. But if we can once agree as to what scale we are using to determine the ugliness or loveliness, just as we have agreed on a scale for the classi-

fication of animals, if we are once agreed as to the scale to be used, there can be no dispute. If we agree that loveliness is a matter of size, a whale is lovelier than a flea, but uglier than the world. If we agree that animals are four-legged, whales and men can't be animals, unless we find four legs in them. But it is clear (is it not?) that you can have no scale unless you use some other word: and a word stands for a pattern (including its circumstances). Hence we conclude that no word can be intelligible by itself: a word is and must be understood in terms of others.

This elementary truth is so disguised by common sense and habit that one hears the most astonishing statements as to what is meant (for instance) by "concrete and abstract nouns." We have all, possibly, had to learn this important piece of knowledge at school. We were solemnly told that we could "touch or see" a horse but not its goodness: most of us swallowed this absurdity. No one ought seriously to assert that we can see "horse" or "goodness": when we say we see a horse, we mean one horse or a horse ONE, just as we can see a big ONE, a white ONE or a good ONE. In all these cases we have the pattern defined or limited by the epithet. Just as that space was limited by being "between the two trees," so *that* (whatever it is) is defined or limited by words (expressed or understood) that give the point of view, or, as we prefer to call it, the scale. It is absurd to suppose that there is something extra important in the "horse" point of view. It may be the most common. To an artist the color may be far more important: and men who worship white elephants, white cats or white horses, clearly worship the whiteness and pay no more heed to the animal part than most of us to the age of animals or the number of eyelashes—both of which scales might be important to notice if they served any practical purpose.

We conclude therefore that whenever we use a word,

we are in fact dealing with a pattern which we think of as ONE, considered from a certain point of view. And instead of using such ridiculous terms as abstract and concrete, we shall recognize the following facts: (1) That all words considered separately *as words* express in some way the limits or qualifications of the ONE we have in mind—granted, of course, that it is practically impossible to define "word" in any satisfactory way, for if *mother-in-law* is one word, any sentence may be called one word, and if it isn't one word, why isn't it? (2) That in order to get meaning it is necessary always to deal with at least two words, one of which is ONE. (3) That when we are dealing with, let us say, ONE qualified by a word like *horse* (i. e., a horse or horsy ONE) or a word like *chestnut* (i. e., a chestnut horse), these words have meaning only insofar as they supply a scale.

A word like *horse* is a difficult scale, it will be better to deal with easier scales first. It sounds a paradox, but it is true, that in ordinary life most of us do not recognize common things like horses and cats by their horsiness or their catness, but by their shape or some other quite unreliable point, just as a peasant might recognize a whale as a fish because it lives in the sea. What we ought to mean by a horse and what we do, as a rule, mean, are different things; and this ambiguity would lead to confusion. A word like IT, though apparently more difficult, is not ambiguous in that way. When we ask ourselves what we mean by IT, we, with our Western education, probably come to some satisfying explanation by calling it a pronoun, disregarding the fact that languages get on very well without pronouns and that a pronoun of the third person ought not to be used impersonally or unpronominally. If we use it impersonally and say "It is raining" or "It is freezing," it is not at first sight easy to determine what "it" stands for. Even if we grant that it is equiva-

lent to a termination, so that we might just as well say *rainit,* we do not get away from the fact that it adds something to the meaning. Such a phrase as *"es gibt"* is translated "there is"; we can say "It is a dog" or "There is a dog." Or we might say "There's freezing" instead of "It's freezing." The phrases undoubtedly sound different: that may be a matter of habit. Is there any difference? We do not, of course, suggest that the word "it" is always equivalent to "there." Such a word as "it" may be used idiomatically: it may often have the meaning of some other word that it has come to replace—as all words may; or it may be used much like a diacritic; or it may have no more meaning than, for instance, the first, the inverted question-mark in Spanish. But if we limit our discussion, for the moment, to the way in which it is used when we say "It's freezing" and consider it side by side with such phrases as "We're freezing" of "They're freezing," we cannot fail to see that the actual meaning of "freezing" changes as we change the other words, just as the "space between two trees" will look different from different points of view. If we talk of freezing, as we do in all these sentences, we are not only concerned with the freezing but with the position of it. We are not necessarily anxious to put our finger exactly on the spot of view; but no one, if he is on the lookout for it, can fail to notice how in passing from one sentence to another—*We're freezing—They're freezing—It's freezing*—we do in fact move in space: and by this movement we are able to understand, sufficiently accurately, the "freezing" in terms of its position. Likewise if I say *I'm freezing—My fountain pen is freezing*—I have changed the position in space and thus changed my view of the freezing. We all know what is meant by blushing: notice how the idea adjusts itself as I move it in space—*I'm blushing* (there's blushing here), *he's blushing* (there's blushing there), *the sky's blushing*

(there's blushing in the sunset). In one sense it is the same blushing—otherwise it could not be described in one word: in another sense it is three different things: but the difference is not in the blushing but in the limits—that is, in the space scale.

Let us take one step further. A Frenchman says *il pleut* or *il plut*. Is it not clear that the distinction here adds a time scale? Thus we have "a rainy ONE" not only where? but when? When we say *he loves* or *he loved*, we have a loving there (i. e., in him) then or now. It sounds vague enough: but it is, in fact, so accurate that, if necessary, we could go on defining our meaning more and more precisely. We cannot, as we have seen, get the statement absolutely accurate: it is never possible to get to the end of the circumference of a circle. But relatively, that is, by taking our point of view, we can fix ourselves on the circle and thus measure the rest and find the relative measure; so with space and time we can pin down our ideas exactly enough, the moment the point of view is assumed. From a given point of view there can be no discussion: it is a matter of reckoning; whereas the choice of a point of view is a matter of taste. Thus if I am looking at a yellow flower, the "a" (or oneness) is an assumption: but given that, we can be interested in the color or the flower: in either case we are (if we mean anything at all) thinking of a scale which is implied by yellow or flower, namely an all-the-colors scale and an all-the-plants scale. If we add another epithet and think of bright yellow or small flower, we cannot understand these epithets unless we are thinking of all yellows or all flowers as scales on which we place, as accurately as need be, the individual instance we are considering. Go one step further—fairly bright, very small, and we have here to think of position on a scale of all the brights and all the smalls.

To return to the chestnut horse: if we are thinking of

the fact that it is a chestnut one, we clearly have a scale of all colors—this is, of all colors, chestnut. But if we are thinking of "horse," it is unlikely that any but a scientist would think of a horse scale. Few of us could explain the essential characteristics of horse. But we all have some idea of its form: and form is the outward and visible sign of movement, a special kind of which is known as growth. It is not possible to determine here how a horse is recognized by the majority. It is sufficient for our present purpose to suggest that, if it is the form that gives the scale, we have as a background and scale for our idea—all possible forms—and, that one which is a horsy one.

Be that as it may, it may help us to see more clearly how the scale works, if we consider the difference between *a kettle singing* and *a singing kettle*. Turning the phrase as before, we have two ONES; one is primarily a *kettle* ONE and the other a *singing* ONE; the next step gives us a singing kettle ONE and a kettle singing ONE. It is clear that, to start with, we have had a scale in the one case, of all possible pots and pans; in the other case, of all kinds of noises.

Hence it seems that in the use of words we are always implying that we are dealing with one particular position or part of a scale. We are always thinking of one with reference to all possible ones. Thus "a horse" means ONE particular spot called horse on a scale that includes all spots (let us say) on the animal scale. The moment I add another epithet I shift to another scale. If we think of the idea represented by a word as a circle, we can see the process more clearly. Horse is a circle which by itself is useless because, unless we select a point of view, we can wander round it forever and ever. But we know that all possible horses exist on this circumference: we speak of a black horse, and at once our circumference is divided into two parts—black and not black. In other words, all

COSMIC PROCESSES.

INTRODUCTION.

THE recent advance of science has been due to rigid specialization. Fields of research have been definitely marked out within which each worker confines himself. The benefit of this method is apparent, but so are its limitations. Nature does not work in isolated apartments but through a unitary process all parts of which are interrelated. A scientist can hardly advance beyond routine investigation without crossing boundaries which science has erected. An economic problem is not solved until roots are bared which relate to geology and physics. Nor can a physician treat disease without a knowledge of chemistry and biology. In addition to this certain sciences have gained a prestige which enables careless thinkers to transfer the doctrines of these sciences over into those struggling for place, and thus to establish a pseudo-science which is little more than repeating the dogmas of one science in places where they do not fit. Much of what passes for deductive economics is merely trite analogies carried over from astronomy and physics. Deductive economics may be said to have arisen when the law of gravity and of the motion of heavenly bodies became a topic in popular education. What is the law of diminishing returns but a restatement of the doctrine of the dissipation of energy? What are the studies of race and personal traits found in sociology except crude deductions from sweeping formulas which biologists have imposed on world thought?

It is not a wanton urge to assault but the need of self-defense that has forced me as an economist into studies beyond my own field. A book on *The Degradation of Democratic Doctrine* by the late Henry Adams shows the handicap from which an economist suffers.

"Within the solar system there is a constant loss of energy."

"All nature's energies are slowly converting themselves into heat and vanishing into space."

"Any restoration of mechanical energy without more than equivalent dissipation is impossible."

"Within a finite time the earth must become unfit for the habitation of man."

Those are the propositions which popular writers dig out of physics to support their views. The universal use of these is shown in the criticism Mr. Salter makes on my recent article (*The Monist*, Jan., 1920, p. 146), where the views of Nietzsche are advanced to oppose my position. "Progressive evolution is limited. At some point disintegration sets in. Chaos returns and in time a process of evolution begins over again." This type of argument merely reflects the mood of the writer. A thousand others besides Nietzsche have argued in this way and reversed their constructive efforts when fancy dictated. There is no one place to throw the wrench into the machinery. It will always work destruction when a writer wants to slide back into chaos.

To alter these formulas does not demand new physical discoveries. So far as facts are concerned they may be found in any text-book. The change is in value and in logic. Some propositions taken from a supreme position are made over into corollaries. The logic of science has changed as science has gone through its epoch-making evolution, but the formulation of its doctrines has not undergone a like reconstruction. The laws of motion, the

law of gravitation and that of the conservation of energy belong to different epochs of scientific advance and harmonize neither in their premises nor in their logic. The old logic deduced its conclusions from dogmatic premises. They were therefore overstatements which gave universality to what was local. The new logic is equational. Until the sign of equality can be put between two series of facts no valid reasoning is possible. To predicate universality is to falsify. If this be true, science should start from the conservation of energy and restate the laws of gravity and motion in formulas which will make them subordinate to the great law of conservation. With the exclusion of psychic assumptions science gains its ultimate goal. It traces changes from form to form but never predicates loss or gain.

THE NEW PHYSICS.

Years ago I wrote an article on the above topic which I sent to a couple of scientific periodicals. One editor replied that he would not dare print it; the other indulged in so much sarcasm that I threw the paper aside. Of late changes in scientific attitude have arisen which arouse the hope that the obstacles to a broader discussion have been reduced. The doctrine of relativity has passed from the stage of a mere conjecture into that of a working hypothesis. Beside this the doctrine of an ultimate atom has been disproved by evidence all must heed. Atoms are not cold unchangeable objects but are active agents capable of dissolution and of an immense discharge of latent energy. These facts lead me to restate my thought strengthened as it has been by new facts.

The law of gravitation assumes that matter attracts matter and that masses move toward each other according to given rules. A second law is the radiation of energy. Energy tends to move apart and to be lost in the distant

recesses of space. Herbert Spencer states this as the integration of matter and the diffusion of energy. My question is: How would it do to turn these two propositions around and say that energy tends to concentrate while matter tends to diffuse itself? If masses of matter and energy move toward each other, does matter carry energy with it as it gravitates, or is energy the propelling force carrying matter along as it unites into larger units? It can easily be seen that matter and energy both aggregate and diffuse themselves, but which is the primary tendency and what are the laws that regulate this tendency? Will not the facts support one statement as well as the other? And where do differences appear by which the two statements can be tested?

It is not necessary to restate the arguments which lie back of the laws of motion as modern science correlates them. As ordinarily stated, energy takes two forms, the energy of motion and the energy of position. According to the law of the conservation of energy the gain of the one means a loss in the other. To call this second form the energy of position does not fully state the facts. The newer knowledge indicates that what seems mere position is not a state of rest but a transformation of linear energy into axillary energy. In harmony with this I assume that the two forms of energy are linear and axillary and that the losses and gains of the one have their exact equivalent in the opposite change of the other. When bodies move toward each other there is a loss of axillary energy and a gain of linear energy. When they move apart axillary energy gains at the expense of linear energy.

How linear energy acts is illustrated in the case of gases which are held together by a commanding attraction. The movements of single particles in this case are not orderly but in every direction, making collisions frequent and inevitable. Of this disorderly state there are three

indices, heat, linear movement and friction. Where one of these is manifest the others are always found. In contrast to these, orderly movements are axillary because they are the only ones among which collision, friction and generation of heat can be prevented. From familiar laws of motion discordant movements in a gaseous body will have selective results. A part of the particles will form orderly ellipses and the rest will be thrown into outer space. All cosmic bodies are of this sort. They may be too small to be visible or as large as the greatest planet, but insofar as they are orderly they are motion- and heat-losing bodies.

Such an analysis contains nothing startling. It might readily be deduced from the received laws of motion and matter. The break comes when the question is asked: Is gravitation like heat and motion subject to counteracting influences, or is it an unconditional force in its manifestation above and beyond all restraint? To say that gravitation is conditioned in its manifestation like heat and motion does not mean to deny the law of gravitation as applied to terrestrial affairs. It means, however, that our gravitational force is true only of bodies of like size, heat and motion. Larger and hotter bodies would have more than proportional gravitational force while colder bodies would have it correspondingly reduced. The degradation of gravitation from an absolute to a relative law would not alter the world as we know it, but other heavenly bodies would have to have their weight, size and motion determined not by absolute standards but by those which are relative.

The accepted statement of physical laws is due to the earlier recognition of the laws of motion rather than of the conservation of energy. It is this which gives the laws of motion their absolute form, psychic predicates being intermingled with objective fact. To avoid this confusion, the laws of motion should not be accepted as original data but

so transformed that they become a consequence of the conservation of energy. The fundamental facts relate not to the laws of motion nor to gravitation but to energy which is the cause of motion and gravitation. Starting from the conservation of energy as a fundamental datum, the first deduction should be that when two bodies come into the same energy-field, that is, when they attract each other, kinetic energy aroused in each is equal, no matter what their size or position. The energy which A expends in moving toward B is the same as the energy B expends in moving toward A. Any other formulation would mean an increase or decrease in the total energy of the universe. A stated fund of energy is thus transformed into motion, and each body, no matter how great or small, has to transform into kinetic energy the same total amount of energy that its opponent does. But while total energy expended is the same, the amount of motion varies with the mass. This again is a deduction. A body one tenth the size of another must move ten times the distance to keep the expenditure of energy the same. This simple law holds so long as bodies move through empty space; but as they approach resistance arises in the form of pressure. This resistance which blocks motion must in its force be equal to the force exerted by the approaching body. The energy of resistance is thus the energy of attraction in a new form. The pressure at any point is equal to the resisted movement at that point. The pressure at any point must therefore equal all the resisted movement which would pass through this point. If so, pressure must vary inversely with the distance from the center of gravity. The surface of a sphere of half the size has a fourth the surface of one double the size. Through each point of the surface of the inner sphere four times the movement must take place as on the corresponding points of the outward sphere. If the pressure at this half-way surface is four times as great

the compression at this point would be four times greater and the friction would be increased fourfold. This statement assumes an axillary motion increased by the compression. If this is true the electricity generated by friction at the surface of the inner sphere would be four times greater than at similar points on the outer sphere. As a result of this higher potential a stress would be created tending to move the electricity outward to points of lower potential. An ingoing body would thus have its movement accelerated by a speed equal to that of the outgoing electric current.

Without attempting to prove my point, is not the fact this? The acceleration of speed by which an unsupported body moves inward is that which would result if the opposition in front were removed. The forward movement is that of a rear pressure unobstructed by front resistance. To explain may be difficult, but the fact is worthy of note and should put the student on the track of the needed explanation. That repulsion can be transformed into attraction is shown by electrical phenomena. Doubtless there is some connection even if the cause is obscure. Physics should deal with facts rather than with causes.

A solution of this problem can be attained by combining the wave theory which Newton rejected with his demonstration of gravity. The wave theory assumes that a partial vacuum exists on one side of the moving wave at the moment when an increased pressure occurs on the other. A shift then takes place reversing the point of pressure and the position of the vacuum, the pressure and the vacuum being each in turn before and behind the line of the moving wave. Newton assumes that a falling body moves a slight distance at a uniform speed and then suddenly increases its speed for another period. There are thus formed a series of steps of increasing speed instead of a uniform curve. If this assumption be so modified

that the falling body moves this infinitesimal distance at a uniform speed and then strikes a resisting body a wave would be formed among the particles of the resisting body. This would make a compression before the falling body which a moment later would be turned into a vacuum, the pressure now being on the rear of the falling body instead of being in front of it. If the falling body halts a moment at the end of each step before going on to the next, it would have a vacuum ahead of it and a pressure behind it, giving a reason for the increased speed. Adding to Newton's supposition a momentary pause at the end of each step would thus bring his proof in harmony with the supposition I am using. What is needed is a transfer of pressure from before to behind the falling body, and however done the result would confirm the Newtonian reasoning.

My main point has, I hope, now been made clear. There is a difference between the attraction of two bodies and the acceleration which takes place as the bodies approach. Attraction is a constant force. Acceleration is a local force due to the increase of pressure. Acceleration is thus not a primary force as the Newtonian law predicates, but is the result of an electrical disturbance. Pressure creates friction and friction generates electricity. It is often stated that the laws of electrical movement are the same as those of gravity, with the important exception that electricity sometimes attracts and sometimes repulses. If when they both work together the gross result is that which either force is said to create when alone, why cumber the law of gravity with an accelerating force which electricity would create? We only need to see what happens when the two forces oppose each other, to discover which is the part each agent plays when they act in conjunction.

A decision must also be made as to whether electrical units are different from other kinetic units, or whether they are kinetic units under special conditions. How can

units which attract be transformed into units that repulse? The reply is that units which normally attract repulse each other when under pressure. When two bodies with the same axillary motion collide they will repulse each other because at the point of contact their axillary movement is in opposite directions. When the movement at the point of contact is in the same direction the current of each is transferred to the circuit of the other, making a figure eight with a circuit double the length of either element. In this way pressure is reduced and the equilibrium of momentum restored. Pressure reducing the length of each circuit disturbs the equilibrium of momentum. The tendency to conserve the momentum would thus force the entanglement of the circuit when a similarity of movement permitted. In this way an opposition between like bodies would result in repulsion, while bodies with dissimilar motion would attract each other. Like thus repulses like and blends with its opposite. This is the fundamental law of electricity reflecting a state which is sure to arise if bodies with axillary motion are put under pressure. The increase of electrical tension would be the same as the increase of pressure. The total speed of bodies without support would thus be the sum of attraction plus that of acceleration.

Acceleration and attraction are thus due to different causes though intimately associated. Pressure is resisted attraction, not an independent force. As soon as bodies enter a pressure-field, the secondary laws of motion begin to exert their influence reversing or augmenting the primary tendency to approach. Compression, heat, friction and electricity are each a manifestation of pressure and grow in importance with the increase of pressure. Together they make the acosmic forces which tear down the cosmic order. To create cosmic stability these antagonistic forces must be thwarted. The main agent in this work is an inverse acceleration by which discordant motions are

thrown beyond the influence of the cosmic bodies. When collision occurs there is not a dead uniformity in the reaction in which each particle receives the same reverse motion. The conservation of energy calls for an equality between the forward and the reverse motion, but it does not demand a similarity in individual cases. There can thus be a concentration of the reaction in the light particles which would give them a speed throwing them beyond the influence of the bodies in collision. Discordant forces would thus be eliminated and the stability of cosmic bodies maintained in spite of opposing tendencies, which, concentrating themselves as heat and light, are dissipated in space. Every disturbing force can thus be resolved into parts, some of which will blend with those making for stability while the lawless elements are concentrated, accelerated and cast into outer regions where they can do no harm. Pressure and its resultant forces are thus transformed into an ingoing acceleration which creates collision, and then into a new resolution of forces a part of which become cosmic while the rest is ejected.

The principle for which I contend is the transfer of velocity from heavy to light particles when collision occurs. This is a fact shown by the act of gases in collision. The higher motion attained by certain particles would not be acquired but by some transfer of velocity. Collision is thus the cause of light bodies moving beyond the sphere of influence of controlling central bodies. In these distant parts what seems absolute on the earth would become relative since what to us is dominant would then be weak or recessive. Contending force would tend toward equality and could more easily be reversed.

THE ORIGIN OF PHYSICAL CONCEPTS.

If human beings remembered the stages of their thought development in acquiring the concepts needed for external

three dimensions, then a fourth dimension is necessary. But before this decision is accepted a reexamination of the laws of motion should be made to see if they cannot be reformulated so as to make movement conform to the demands of space as we now conceive it. A new formulation of the laws of motion must begin, not with assumed sense-perceptions such as straights, planes, solids and the like, but with measurable objective facts by means of which psychic predicates are eliminated. The mixture of subjective and objective concepts should always be avoided and this has not been done in the laws of motion to which Newton's name is attached.

A clearly defined objective standard can be obtained only by the use of the law of the conservation of energy. Motion must conform to it and not it to the psychic predicates of motion. Can objects move straight as psychically defined and yet be conserved? In some way movement must return to itself if energy is conserved, and if so, there is some defect in the psychic predicates about motion. We should therefore begin with the conservation of energy—an objective fact—and see from it and its corollaries what is the error in our psychic predicates. We thus obtain facts in harmony with, or derivable from, the conservation of energy.

1. No body can alter its position in space without altering the position of other bodies.

2. Energy tends to concentrate, as a result of which bodies move toward each other.

3. Energy is conserved.

4. Momentum is conserved.

5. Speed is conserved. Any transformation by which speed is lost is compensated for by another by which speed is gained. If it were once ascertained what is the average speed of all bodies in space that average could not be departed from. In its application this is a broader generaliza-

tion than the law of motion which affirms that action and reaction are equal. The difference is that the later statement is based on sense-perceptions of the action of colliding solids. Here each particle reacts as a part of a solid mass and not as an individual unit. There can thus be no acceleration or loss of speed on the part of single units. This rigidity applies only to solids. In other forms of matter the acceleration and retardation of molecules is conditioned only by the fact that no net gain or loss of speed can take place.

All motion is a change of position of one body in its relation to others. There is no absolute motion nor any absolute rest. The first law of motion is therefore an overstatement. There is no body at rest nor any body moving in a straight line uninfluenced by other bodies. If it moves, some other body is in motion. Every motion is a relation between two moving bodies. The net change is that from which psychic predicates of space are derived We see the motion and infer a plane in which the movement takes place. Space, straight lines, planes and solids are thus not entities but inferences by which observed motions are explained.

So long as but two bodies are within the field of consciousness the relations between the two are expressible in terms of straight lines and their movements are within a single plane. Two-dimensional space is thus observable and from it we derive our notions of other forms of space. We make three-dimensional space by combining three two-dimensional planes and thus give to the enlarged notions of space the same attributes which have been affirmed of two-dimensional planes. It is, however, questionable if three-dimensional bodies are made of planes which fit in the manner Euclidean space predicates. If some of these planes are warped, then a movement in this plane would be curved.

The question I raise is this: If two-dimensional planes were united to form a three-dimensional body, would not some of the planes have to be warped to make them fit into their new position? Is, in other words, psychic straightness seen in two-dimensional relations the same as the straightness of three-dimensional bodies? Or, again, are not three-dimensional bodies non-Euclidean in their relation to two-dimensional bodies? It seems to me that there is no difference in saying that the space in which bodies move is warped—a deduction of non-Euclidean geometry —and saying that the planes of two-dimensional bodies and those of three dimensions do not exactly fit. Straightness for the one is not straightness as measured by the other. The difference is that in one case we are talking in terms of objective relations, while in the other we are using terms derived from ideas constructed to explain these objective relations. The dimensions of bodies are reals; the space they occupy is a mental construction.

This thought that the dimensions of bodies do not fit leads to the thought that bodies we assume to be solid are not solid but a a group of movements in different planes. What we call solid is merely pressure coupled with a feeling of muscular resistance. If we cannot compress, or if a body seems at rest, we call it solid and affirm that two bodies cannot occupy the same space. Yet the facts directly given do not warrant such a conclusion. If what seems solid is in reality a group of moving planes, then another body could go through this body if its movements were in one plane and thus could avoid the planes occupied by the first body. All bodies are thus resolved into two-dimensional bodies moving in diverse planes. Combine them and we get three-dimensional bodies, and there could be four-dimensional bodies or bodies of any number of dimensions if they were needed to explain observed movements. Yet there would be no exclusion between these dimensions.

A two-dimensional body could move through a three-dimensional body, and a three-dimensional body could move through the area of a four-dimensional body. Ether, if it exists, is four-dimensional since three-dimensional bodies can move through it. All that bodies of a higher dimension can do is to twist bodies going through them out of their natural plane since these bodies must avoid occupied planes.

If this be true the dimensions of bodies have not those fixed relations which go along with our concept of solids. What psychically we regard as solid is really a number of interlocking planes each of which has its diverging movements and tendencies. The dimensions are therefore not perfect according to Euclidean standards, but alter and twist as the conditions external to them vary. There are one-dimensional tendencies, two- and three-dimensional tendencies, each being in a measure antagonistic. Pressure is two-dimensional and any reaction of pressure causes a divergence of the interlocking planes and thus strengthens three-dimensional tendencies. Pressure forces bodies to occupy less space and thus forces the planes of a body more into parallel positions. Take off the pressure and the three-dimensional tendencies are restored. We cannot say that a body is ever completely in any of these forms since by the influence of opposing bodies some of its planes would be distorted. The same definition of straightness would not apply to all of them and hence the movement in some of the planes would be non-Euclidean.

The essence of this thought is that bodies not only exert an influence on the movement of other bodies—attraction and repulsion—but they also exert an influence on the form of other bodies. Every body, we may say, has a dimensional influence on every other body in the universe.

Another way of viewing this law, or perhaps a modi-

fication of it, is the influence which in animal life is called tropic. A current passed through the body of an insect twists it into a curve. This would indicate that traverse currents bend the bodies through which they pass, which if it were a universal tendency would cause each body in the universe to exert some influence on the form of every other body. There would then not only be action and reaction between bodies due to attraction and collision but a tropic reshaping influence which would determine the line along which bodies move. Just as an insect bends out of a straight line in its motions when under tropic attraction, so every body bends a little under the influence of its neighbors. Nothing would move quite straight according to Euclid except an isolated body, and it would not move at all.

The assumption on which I have gone in making these deductions is that the conservation of energy is the primary force and that all movement is conditioned by it. Thought is thus made objective and increased in its universality. It shows that psychic predicates about motion and space either are not true or they are not universal in their application. Space, as we conceive it, is a relation between bodies and not a statement about the composition of bodies. We get our ideas of planes from these inter-body relations and then assume an exact correspondence between these conceived relations and the bodies themselves. We arrive at the concept of a non-Euclidean space as soon as we transfer our attention from the space that bodies are supposed to occupy, to the movements which bodies make. Then we have to conclude that either space in some of its parts is warped, or that the bodies in it are warped in their planes.

These facts are put in a more concrete form when we recognize the influence which pressure exerts. Around the great centers of concentrated energy pressure creates

cosmic relations. Outside of these pressure areas the acosmic tendencies dominate. We should not think, therefore, of particles moving out from these energy centers and being lost because the straightness of their movement isolates them from other bodies. The influence of each body on others is never lost. The interactions in outer space are the same as within pressure areas. But the movements and interactions give confused results. Bodies bend, twist and turn, but do not establish fixed relations of the sort a cosmic world reveals. The problem then is not one of losing energy. No energy or relation of energy is lost. What we need to discover is how this acosmic confusion is transformed into cosmic worlds. If order cannot be established and other worlds built, the practical result is the same even if the theoretic position is altered. Old worlds do decay. They lose energy. There would soon be a cosmic blank if order were not restored. We have shown what is the process by which the losses occur. Perhaps the same forces which destroy order can in the end restore it.

THE EVOLUTION OF COSMIC ORDER.

The scheme I have outlined does not differ from accepted views as to disintegrating forces which destroy cosmic bodies. Heat and light are lost with the result that the central body cools, contracts and loses its luminosity. If gravity is the result of a constant force due to attraction and an acceleration is due to increasing pressure, then the loss of heat and light reduces pressure and with it the element of acceleration in gravitation will fall off. The ejected elements are elements discordant to the cosmic order. Each gain in order indicates a loss in substance, pressure and friction. Cosmic bodies would thus become cold bodies with less cohesive power. They would exert less influence on hot bodies while hot bodies would exert a greater influence on them. Hot bodies would thus pull

cold bodies asunder or at least warp them to a greater degree. In addition to this the reduction of gravity would affect the outer parts of a body earlier than the inner. The pressure would thus be taken off the interior mass which by expansion would crack the surface parts. The net result would be that cold bodies would break apart and float off as discrete masses, each of which would continually redivide until a wide dispersion through space occurred.

This dissolution presents a different picture from that of the accepted view. Cold bodies hold together if gravitation is an absolute quantity. The one plan would thus assume the existence of large dark worlds plunging heedlessly through space at tremendous speed, while the other would have the same cold matter dispersed moving at a slow rate until it was absorbed into some new solar system by drifting into its sphere of influence. It cannot be said with certainty that there are immense cold bodies dashing through space. To meet such a body would end all life in a hurry. But it can be said that there are multitudes of small cold bodies drifting aimlessly about. The earth comes in contact with them daily. The presence of numerous asteroids in one portion of the solar system indicates that one planet has already broken up. Mars seems to be going the same way if what has seemed to be canals are really cracks in her surface. This would be a confirmation of the belief that cold bodies lose some of their specific gravity.

This explanation is at best partial. If nature is composed of orderly processes the loss of matter or motion due to the ejection of particles must be accounted for as well as the drift of cold matter which finally is reabsorbed in the active solar bodies. There must be some way to bring back into organic unity the ejected hot particles whose loss if permanent would drain the universe of its energy. This

is not an impossible task if the laws of motion as well as the force of gravity are relative. To get this new viewpoint we must assume that the ejected particles will as they move transform their energy from linear to axillary energy and thus cooling off would slow down as they move away from the ejecting body. In the end they would become cold bodies and be subjected to the laws applicable to cold planetary bodies. If a planet revolves about a sun or a moon about a planet there could be no change in the moment of momentum, but the tidal stress would slow down the revolutions until there would be one revolution of the cold body about its axis with each revolution about the sun. This is the inevitable result of tidal stress as is shown in the case of the moon and the lesser planets. Such is the fate of every cold body. Its momentum does not force it to move in a straight line but compels it to move about some hot body with its heavy side toward the heat. Microcosms are subject to the same laws as are planets and suns. They would therefore keep their momentum but curve about some central body. The gravitational force of hot bodies on the cold may be slight in the distant parts of the universe, but however slight it would produce inevitable results. The cold body always becomes a satellite of its hot neighbor. There would thus be a current of cold atoms about every hot body, and the universe itself would have an external ring in which even the lightest bodies would become entangled. If a particle was carried by its momentum beyond the influence of any particular sun the joint effect of all the suns would have a unified effect as soon as the bounds of the visible universe were crossed.

There would then arise a simple situation. The ejective force which came from some earlier collision or compression would be set against the combined pull of all the suns. Both forces would be on a decline but the ejective force

would fall off more rapidly than the force of gravity. At length the particle would come to the peripheral plane where the two forces were equal. The net result would be a movement along the peripheral plane with the heavy side of the particle turned inward toward the center of gravity. Assuming such a peripheral current to be started, the consequences would soon become apparent. The radiation-pressure would be a constant force since the quantity of radiation for the whole universe would be fixed. Gravity, however, would increase as the quantity of matter in the peripheral plane is augmented by new arrivals. The peripheral current would thus gradually contract and move within the peripheral plane. If so, particles would arrive at the plane of the current with some ejective force still active. The result would be that the bodies in the plane would increase their momentum through the ensuing collisions. A part of the ejective force would thus be absorbed in the primal peripheral circuit, but another part would rebound in the opposite direction creating an outer secondary current in the opposite direction. No matter in what direction a particle entered the plane nor with what force. it would finally be resolved into two forces going in opposite directions. Heavy particles would remain within and move with the inner current while the lighter ones would be absorbed in the outer current.

There would thus be stable cosmic conditions in this outer zone with no heat, no pressure and no friction. It is this orderly condition which should give us the picture of what happens wherever cosmic forces dominate. There would be a discordant center where cosmic forces never are in complete control, but there would also be two rings moving in opposite directions at the peripheral plane. Friction, collision and pressure may destroy the simplicity of the process, but every cosmic body tends to shape itself in this way.

If this is true we only have to watch the process through its next stages to see how the acosmic forces again come into play and thus compel the evolution of solar systems. Each addition of matter to the peripheral currents tends to draw them nearer to the central bodies and increase their speed. But the moment of momentum will not permit this contraction. The same distance must be traversed in each circuit as before. To do this, the currents must as they contract in their circumference increase their sinuosity. This would cause pressure, distortion and displacement. Heat would be generated and the attractive force increased not only in regard to central bodies but of the peripheral particles on each other. The result would be increased torsion; knots would be formed and then spirals. The mass would thus be thrown into the form in which the solar nebulæ are known to exist, the subsequent transformation of which into suns and planets is readily explained according to familiar laws. The cosmic process thus has two phases, in one of which heat, collision, pressure and friction increase. In the other these acosmic forces decrease and the simple cosmic tendencies prevail. A solar system runs down as it gives off heat. It revives as its particles are brought into order at the peripheral plane. A repeating order of events is thus secured. Each cosmic event has its antecedent and its consequent which in turn becomes the antecedent of the next step. There is thus no beginning nor end. Every step is so orderly that no need remains for the accidents, collisions, explosions, etc., on which the older scheme of the universe depended.

THE MOVEMENT OF SATELLITES.

The thought of the preceding section may need a supplement to make its bearing clear. The ejected elements must be traced and their return vouchsafed before a rounded system for the universe can be predicated. If the

conservation of energy is the ultimate law the ejected bodies have no energy except that derived from the parent body. Attraction creates pressure, pressure necessitates collision and in collision the discordant elements are ejected. But in being ejected they do not lose their ultimate relation to the parent body. They become satellites, if this word will bear an extension of meaning so as to include all ejected bodies which do not immediately through gravitation return to their source. Satellites are defined as bodies revolving about a central body. If ejected bodies become satellites the two can readily be designated by one term.

To prove their identity demands not enunciation of a new principle but merely a deductive application of what has already been shown. The central body from which the ejected elements arose moves with a high speed. If a particle is cast off at an angle from the motion of the parent body the attraction of the latter will not be an exactly opposing force to the movement of the ejected body, as would be the case if the parent body was stationary. Its movement makes the line of attraction an oblique angle instead of a perpendicular. The ejected body would swerve from its initial path in the direction taken by the parent body. It would thus move in a curve instead of a straight line which in the end would become parallel to the movement of the parent body. To see what would happen the acceleration of each body must be isolated from the attractive force which each body exerts on the other. Acceleration is the momentum derived from some earlier opposition of primary forces. This acceleration must be much more powerful than the primary attraction to create the curve described. Not only must its acceleration dominate over attraction but its acceleration must be greater than that of the parent body. It is then thrown ahead of the parent body and becomes a satellite by revolving about

the central body instead of returning to it. Every expelled body thus comes under one of three heads. If the attraction is greater than the acceleration it returns to the central body. If its acceleration is less than that of the central body a return can also be predicated. In the third case, where the acceleration exceeds that of both the primary attraction and the acceleration of the parent body, a satellite is formed which revolves about, instead of returning to, the place of its origin. Any ejected body must return to the parent body, become a satellite or be thrown so far away that it comes under the influence of some other solar system.

Given these facts, still another predicate is possible. Every moving body or aggregate of moving bodies has a medial plane along which the aggregate movement takes place. This plane must average the opposing forces and of the diverging tendencies have as much on one side as on the other. The discordant tendencies will accelerate the movement of particular bodies by side movements which as soon as they begin will be thwarted by dominant tendencies of the parent body. Particular bodies will therefore curve in their movement and be transformed into satellites, or through attraction return to the parent body. Side movements, although perpetually recurring, are temporary in their effects and have no influence on the medial plane along which the parent body is moving. Any solar system tends to become a moving disk, narrow on its sides but greatly extended along its medial line. Gradually opposing side movenents will wear themselves out and each minor body will have a medial plane parallel to that of the parent body. The attraction of the central body will also slow down, by tidal stress, the revolutions of each satellite until it revolves on its axis but once with each revolution about the central body. The victory of cosmic forces in any solar system would mean the formation of a narrow

linear plane with all minor movements in exact conformity with the medial plane of the whole system.

Extending this thought to the whole universe, there would arise for it a medial plane along which the various solar systems would tend to group themselves. The universe would thus become a narrow disk opposing movements within which would tend to equate each other. Such seems to be the case, as indicated by the Milky Way, in which the great mass of stars seem to be. Not only the stars but all planetary bodies seem to be controlled by these major tendencies. Order dominates in the end through the ejection of discordant forces and their reaggregation in new cosmic forms.

To this medial plane the concept of straightness cannot be attached unless it is made to apply to the medial plane of the whole universe. Each divergent movement from this plane, whether on the part of individual solar systems or of any minor body in any particular system, would result in making the medial plane of this system or body a curve in its relation to the major body or to the whole universe. Each body exerts a dimensional influence on other bodies as well as the influence we call gravity. Each body thus tends to curve the medial plane of all other bodies whose medial planes are not parallel to its own medial plane. We should not say, therefore, that bodies move in straight lines but that they move along the line of their medial planes. Every such plane is more or less warped as it deviates from the medial plane of the whole universe. Neither should we say that space is warped, since space as we know it is a mental concept derived from our psychic experience. But we can say that practically every movement of bodies in space is warped in that each particular movement is controlled by the medial plane of the system to which it belongs and this plane differs more or less from the medial plane of the whole universe. There are thus

as many different concepts of straightness as there are planets inhabited by conscious beings.

This reasoning may seem obscure but if analyzed it will be found to differ but slightly from that used by Newton. In his discussion of elliptic orbits he assumes a central body with an attracitve force coming into relation with a small body moving in some direction not the same as that induced by the attractive force of the central body. This situation would create the centrifugal and centripetal forces which together create elliptic orbits. The smaller body must under these conditions be a body whose force is not derived from the central body. His theory of elliptic orbits is therefore a "capture" theory, the satellites being of foreign origin. He has no way of turning centrifugal force into centripetal force. I desire to show the possibility of such a transformation and thus to show how the force of the satellite is not foreign but is derived from the parent body.

The movement of an ejected body would be exactly opposite to the attractive force of the parent body if the parent body had a fixed position. The inverse movement would in time wear itself out and a return to the parent body would be inevitable. This is the supposition which Newton makes and upon which his reasoning is based. He regards the parent body as having a fixed position and thus simplifies the problem he is interested in solving. The assumption of foreign bodies captured by central suns fell in with the views of the time and hence provoked no discussion. The reasoning involved is seriously modified and much simplified if instead of a fixed central body a moving body is predicated. Now the attractive force of the parent body and the expulsive force of the ejected body will not be exactly opposite. By its own motion the attractive force of the parent body strikes the ejected body at an angle. Two forces, both central in their origin, thus act on the ejected body and its movement will be the re-

assume that in early ages water was mainly carried in the aerial currents falling to the earth only when these currents broke. Then we would have an ice age where these deposits were made. These would be gradually melted through terrestrial heat. Water would run toward the low parts of the earth but these being hot would soon transform it again to vapor after which it would again ascend to aerial regions until a new disruption brought on a new ice age.

If this hypothesis is correct, between each two ice ages there would be an arid age. The surface currents would be dry and hot, licking up the surface water except in protected spots. There might be lakes, ponds and small streams but no ocean as we now know it. These arid periods would give a hot climate to a much larger portion of the earth than now. It might even extend into the polar regions and make them the spot for early vegetation. The dry ages would turn the earth into vast deserts with a tremendous surface drift of material due to the strong hot currents of the air. The drift of sand in our present deserts would be an index of the larger transformation of land taking place in earlier ages. Drift on the surface. dumping from above, and ice would then be the main agents in giving the earth its present form. The bed of the ocean would be where it is but in it water would not remain permanently until the ice ages pass. When the earth is cool enough to have a permanent ocean these early transformations of its surface would cease and bring the minor forces into control which at present manifest themselves. Oceans would thus be among the last features of the earth to be formed even if we assume that the ocean-beds were in formation from the very start. The bulging of continents and the depression of ocean-beds are due to forces not unconnected with aerial currents and yet disconnected with the presence or absence of water in them.

I have assumed that the resolution of forces due to the upward movement of hot particles would create two peripheral currents moving in opposite directions. The heavier material would be in the inner current, the lighter in the outer. When the break comes and the cold deposit takes place the lighter material from the outer current falls on the northern hemisphere while the heavier material from the inner current falls on the southern. That the dominant currents north and south have different origins is indicated by the fact that southern tornadoes revolve in an opposite direction from the northern. All storms thus seem to have their origin in these upper currents, and if so, their source can be determined by their circular direction. If this is in a measure true the northern deposits would be colder and lighter, mainly of ice. The south would thus not only grow heavier but the northern material would either flow south as it melted or would rise again and be absorbed in the peripheral currents. The growing weight of the south would thus depress its material and cause a rise of the lighter material at the north. This would in a rough way correspond to the known facts and thus make the aerial currents a source of the uplifts and depressions on the earth's surface.

According to the Laplacian hypothesis the planets were formed by contraction when the body of the sun extended to the orbit in which each planet now moves. A huge mass is thus thrown off at once out of which the planet is built. The outer planets are thus the older and hence should be the colder, which is not a fact. In contrast to this I assume that the material of each planet accumulated gradually when its orbit was the peripheral plane of the central sun. Part of the sun's matter would thus be forced upward to it by heat while another part would come from the cold material which drifts in from outer space. The accumulated material would in the end cause a break in the periph-

eral currents and then a hot body would result from the conflict of the two peripheral currents, the same as in the original nebula from which the sun arose. Planet-formation is thus the same in origin as sun-formation, the difference being only in the magnitude. If this is the case the inner planets are the older and the whole planetary system much younger than the Laplacian hypothesis assumes. At first the attraction of the sun would be too strong to permit material to remain on any external plane. There might be great masses of material thrown outward but it would soon sink back into the original body because of its heat. Only after considerable shrinkage would a permanent peripheral circuit be possible and then only could planet-formation begin. At first the current would be near the central body and contain much heavy material, but as the material cast off became lighter the peripheral current would be farther away and have for its content the lighter gases. To this scheme the planets conform. The outer bodies are lighter and hotter, indicating a later origin. The inner planets are about four times as heavy as the outer and show more fully the marks of age. The asteroids seem to be the remnant of an early planet while Mars by its cracks seems on the verge of a like dissolution. If heat and lightness are the indices of youth the planets do not conform to the demands of the accepted hypothesis of their origin.

I wish to emphasize anew how important is the hypothesis of two opposing peripheral currents in any purely physical explanation of a cosmic universe. Even the smallest bodies tend to form a nucleus and two opposing currents. This seems to be the only plan which permits cosmic evolution. The difference is not in this simple cosmic struggle for order and permanence but in the opposing forces which promote dissolution. Small bodies are more subject to pressure, collision and friction than are the orbs

which float in outer space. They thus lose the symmetry which the larger bodies have but at bottom act in the same way insofar as cosmic forces control. A thunderstorm or a cyclone show the same striving for orderly movement and are disrupted in the same fashion as are the currents of the immense outer circuits from which huge nebulæ are formed. Matter assumes chemical and electrical forms as the cosmic forces are overpowered by the dissolving energy which pressure, torsion and friction exert. They create unstable products so at variance with the underlying cosmic plan that they seem causes rather than consequences. Yet each of these is the result of the simple cosmic forces they seem to overthrow. If energy tends to aggregate all else follows in an orderly series, each step not leading to an ultimate but to some form which tends to restore the original condition. Cause becomes effect and effect in turn is cause. The opposites are thus in the end harmonized since they both are parts of a repeating process.

The construction of solar systems is best explained in Professor Chamberlain's *Origin of the Earth.* To it the reader is referred, but there are differences between his explanation and mine due to the rigid way in which he holds to the Newtonian laws of motion. If these laws are not absolute but secondary expressions of the conservation of energy there is an easy transfer from his view to mine. I go a step farther back than he does in seeking the beginning of planetary evolution. The mechanism of peripheral planes would lead to the formation of knots and spirals from which he takes his start.

The first difference, however, would be as to the way in which planets are formed. He assumes they are ejected as a solid mass due possibly to the influence of some colliding body. I would say that planets are formed by the same processes which create suns. The scale is less grand but the forces are the same. Every hot body ejects small

particles. If the principle of inverse acceleration is correct a steady stream of swift-moving particles would be ejected from the central body which would form peripheral currents like the original currents out of which the central body arose. The same forces would ultimately create a new knot with spiral movements and in the end a new planet would appear.

A second difference would result from the place where heavy material originated. Professor Chamberlain infers that the interior of planetary bodies is heavier than their external parts. This would seem to be due to the tacit assumption that the combinations which increase specific gravity arise as the heat of compression increases. I would regard it as more probable that the combinations are made not at the center but at the peripheral plane. Hot particles are ejected. They cool and unite. Then they fall back on the surface of the central body. The crust of a planet would then be composed of heavier material than its interior. If so, the distortions, elevations and depressions of the planet's surface receive a ready explanation.

These doctrines seem to break with the accepted laws of physics, but in reality they merely generalize them. In the place of constants capable of verbal expression, variables are inserted for which language has no equivalents. Transform Newton's verbal laws into mathematical formulas, and all the alteration can be made which the new physics demands. The two new variables of which I have made use are those relating to gravitation and reaction. If gravitation falls off as bodies cool, the measurements of gravitation are an inadequate expression of the activity involved. If also the reaction after collision is not the same for all particles, there being a transfer of motion from heavy to light particles, the verbal law again fails and a mathematical formula is needed to express the old relation in new terms. But none of the ultimates are al-

tered by this change from concrete words to mathemathical language.

There is another way of expressing this fact which needs emphasis. The absolutes which have crept into science are remnants of psychic postulates which dominated human thought before the dawn of the scientific epoch. Thought was then moulded by the psychic attitude of the observer and was regarded sound if it could be stated in dogmatic postulates. To eliminate these psychic presuppositions is to change rigid verbal laws into mathematical formulas each member of which is a variable. It is these unbending psychic postulates which are now being questioned, and science becomes pure as they are being eliminated. Nature is variation and sequence, not rigid and absolute. When verbal laws are judged in this fashion their psychic defects become apparent. Straight is a psychic absolute. So is equality in the phrase "Action and reaction are equal." The real physical tendency back of these formal statements is expressed by the conservation of energy which has no psychic equivalent.

One group of thinkers regard the psychic as ultimate and interpret nature in its forms. This is philosophy. Modern science, on the other hand, tends toward mathematical expression, thus replacing absolutes with variables. An illustration of this is given in the conflicting notions of space made prominent by the difference between Euclidean and non-Euclidean geometry. The Euclidean postulates are psychic. The non-Euclidean are designed from, or at least conform with, the actual movements of bodies in space. We predicate that light moves in straight lines and hence that bodies are where and what they seem. If, however, light moves in curved lines our psychic predicates are inaccurate. Law is not law until the psychic is eliminated, and this means that law is law only when it expresses a relation between variables.

cordant motions which are dissipated as vibrations or ejected by giving increased velocity to small particles.

12. Heat is absorbed by the growth of molecules and given off by their division.

13. Cold bodies tend to disintegrate, while hot bodies increase their attractive force with their heat-growth.

14. The energy of electricity is the energy of pressure making the laws of pressure and the laws of electricity the same.

15. The acceleration at any point is equal to the pressure at that point.

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THE END OF MARK IN THE CURETONIAN SYRIAC

AND THE FUTILITY OF USING IT TO SUPPORT THE APPENDIX.

IT is well known that, in the London manuscript of the Old Syriac Gospels, the whole of Mark is missing except verses 17-20 of the last chapter. The fragment reads thus:

. . . that believe in me; these in my name shall cast out demons; with new tongues they shall speak; serpents they shall take up in their hands; and if any poison of death they drink, it shall not hurt them; on the diseased they shall lay their hands, and they shall become sound.

But our Lord Jesus, after that he had commanded his disciples, was exalted to heaven, and sat on the right [hand] of God. But they went forth, and preached in every place, and the Lord [was] with them in all, and their word he was confirming by the signs which they were doing.

Endeth Gospel of Mark.

In the first edition of this Version (London, 1858, p. xliv) William Cureton, its discoverer, said:

"This very small remaining Fragment of St. Mark is an early testimony to the authenticity of the last twelve verses of this Gospel, which have been deemed spurious by some critics."

In 1912, Sir Frederic Kenyon can still say of this fragment, that it "is sufficient to show that it contained the

last twelve verses of the Gospel." (*Handbook to the Textual Criticism of the New Testament*, 2d ed., London, 1912, p. 155.)

Yes: it contained them, but did it ascribe them to Mark? *Until we know what an ancient manuscript said at the juncture of the Gospel and the Appendix, we cannot tell how it treated the latter.*

Now, there are only two manuscripts extant of the Old Syriac Version: viz., this one and the Lewis Syriac on Mount Sinai, which omits the Mark Appendix altogether, clinching the omission with the red colophon at xvi. 8:

Endeth Gospel of Mark.

But while the Old Syriac has been reduced to two manuscripts, the Old Armenian survives in hundreds, five of which are in Philadelphia, and at least one apiece in Boston and New York. (There is a Syriac fragment in Berlin which probably belonged to the London Manuscript when it was in Egypt before 1842, and which shows the absence of the woman in adultery from John viii.) All scholars agree that there is a close relationship between these two neighboring Versions, the Syriac and the Armenian. Indeed, Armenian historians testify that their first translation was made not from Greek, but from Syriac. As was shown in a former article,[1] all Armenian manuscripts before A. D. 989 end Mark as does the Sinai Syriac, with the red colophon at xvi. 8. It was further shown that even those manuscripts which contain the Appendix often adopt various devices to mark their disapproval of it. One ascribes it to Ariston the Presbyter in a rubricated title squeezed in between verses 8 and 9; others say at verse 8:

Read for the Ascension.

[1] "The Six Endings of Mark in Later Manuscripts and Catholic and Protestant Imprints of the Old Armenian Version." (*Monist*, Oct., 1919.)

Others add the Appendix, but put the old colophon at xvi. 8, showing that this was the original end of the Gospel, fixed by the first translators (early fourth century, as Kenyon himself informs us, *op. cit.*, p. 172). They then begin the Appendix with a repeated title:

Gospel according to Mark.

Frederick Conybeare has told us that the Armenian Version is so slavishly literal and so accurately copied, that a medieval Armenian manuscript is equivalent to a Greek one of the fifth century. He might have added, or a Syriac one of the fourth.

Besides Armenian Manuscripts, Codex L at Paris, and other Greek ones, such as No. 1 at Basle and 209 at Venice, support my contention, as well as the Old Latin at Turin and the South Egyptian Version.

Now, *until we know what the London Manuscript said at Mark xvi. 8, we must cease to quote it as an authority in support of Aristion's Appendix as part of Mark.* Therefore, all critical editions of the Greek Testament, including Tischendorf, Tregelles and Soden themselves, must be corrected in their apparatus at this point.

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P. S. I have just secured the photograph of the oldest Armenian manuscript, A.D. 887 (Moscow, 1899). Of course it omits the Mark Appendix, the Adultery Section in John, the Bloody Sweat in Luke, etc.

CRITICISMS AND DISCUSSIONS.

ON REALISM.[1]

It is of the so-called New Realism that I wish to speak in the present lecture. The neo-realistic movement is one which has arisen among certain American university philosophers within the last twelve or fifteen years and which reached its most adequate expression in a cooperative volume published in 1912, entitled *The New Realism*. It is to be noted that a similar and related English realistic movement developed during the same period but that this movement cannot claim to have reached as high a level of systematic formulation as the American movement. At any rate, the subject of our present discourse is the American realistic school rather than the school of Nunn, Alexander, Moore and Bertrand Russell (in his earlier development). The chief documents for the study of the American realistic school are the collection of papers just mentioned, Perry's *Present Philosophical Tendencies*, Spaulding's *New Rationalism* and Holt's *Concept of Consciousness*. The literature is thus delightfully slight in quantity! (There are, of course, many works of realistically inclined philosophers, which would deserve enumeration in a complete bibliography.)

The chief characteristic of the realistic movement is undoubtedly its negative and destructive character. The realist practises a severe and unrelenting criticism upon all existing systems of philosophy. He tears down the pleasing speculative structure of absolute idealism, with its religious and esthetic values, and he is equally willing to show the flimsy character of pragmatic relativism. It is only natural, therefore, that those who have been accustomed to draw intellectual and emotional satisfaction from either of the two dominant systems regard the realistic polemic with no small degree of apprehension.

The realist approaches the problems of philosophy in a spirit

[1] A Public Lecture delivered at the Rice Institute, April 21, 1920.

of exact reasoning. His ideal is that of exact science. It is precisely at this point that he is opposed by the dominant schools. Both pragmatists and idealists have, under the influence of romanticism, persuaded themselves that exact science is, as they say, abstract, and thus not true of the concrete world. They believe that mathematics and physics are merely games played with abstract concepts which lead us the further from the truth, the longer we play. The real, wherever it may be found, is not (pragmatists and idealists agree) the world of mathematical science. And philosophy itself must not have an exact and rigorous form. It must be speculative, profound, suggestive, rather than precisely true. Now the realist differs from the pragmatist and the idealist in demanding that philosophy be an exact science, or at any rate as exact as possible; that it work in the spirit of mathematical and natural science. And in making this demand for close correlation between science and philosophy, realism is true to one very important tradition in the history of philosophical thought. Side by side with the speculative and theological tendency we have a scientific tendency running through the whole history of philosophy. Plato, Descartes, Leibniz and Kant may be mentioned as having connected philosophy with exact science; Aristotle and Hume as having connected philosophy with biological and psychological science respectively.

Realism means, then, first of all, an examination of existing systems according to canons of rigorous argumentation. In the course of this polemic, however, a certain beginning is made toward reconstruction. The future of realism no doubt consists in carrying on the work of positive and constructive thinking. But for realism it is not of prime importance that a system of philosophy be reached; what is important is that the canons of scientific method be observed. If no system can be reached by these methods, then we must have no system and the business of true philosophy must consist in a perpetual refutation of all false philosophies.

What, then, is the realistic doctrine? First of all, it affirms the theory of epistemological monism. This doctrine is one which is frequently found among philosophers but which is often made the basis for false inferences. Epistemological monism affirms the identity of the perceived or otherwise cogitated object with the real object. The opposite of this is the doctrine of representative perceptionism, which holds that when I perceive a tree there are two things involved, first the tree, and secondly my idea of the tree, and

that my idea of the tree may be like the tree, in which case it is true, or unlike the tree, in which case it is false. This correspondence theory of truth, this assumption of a duality between ideas and things so that the former can copy the latter, realism rejects. And in doing so it is in accord with the weight of philosophical opinion at the present time. The difficulties of epistemological dualism have often been exploited. If my idea of the tree is true when it corresponds to the tree, how can I ever become aware of the truth or falsehood of my idea? For when I attempt to compare my idea of the tree with the tree, it turns out that the latter is itself only known through my idea, and that, consequently, I can only compare my idea with itself and never with the outer object. To compare the idea with the outer object implies some sort of direct contact with the outer object and that is just what representative perceptionism or epistemological dualism denies. The realist assumes the possibility of knowledge, consequently the possibility of distinguishing the true from the false, and he is thus logically forced to deny the dualistic theory, although it must be said that this dualistic theory is almost the only one known to common sense and is embodied in many linguistic forms.

Now this rejection is the point of the first article of Perry's "platform" (1910): "The object or content of consciousness is any entity in so far as it is responded to by another entity in a specific manner exhibited by the reflex nervous system. Thus physical nature, for example, is, under certain circumstances, directly present in consciousness. In its historical application, this means that the Cartesian dualism and the representative theory are false; and that attempts to overcome these by reducing mind and nature to one another or to some third substance are gratuitous."[2] We may note that this plank implies Perry's special theory of consciousness, which, however, is not accepted by all the other realists. This theory of consciousness has the merit of extreme simplicity, for it consists in the sharp denial that there is any distinct type of being to be found corresponding to the word consciousness. The notion of consciousness, of an inner mental life, different from, although mysteriously related to, the bodily life, Perry holds to be a superstition.[3] What is real about consciousness is simply the fact that beings said to be conscious make certain responses to the environment which others do not. We assume an inner principle to explain

[2] Cf. *Journal of Philosophy*, etc., 1910, p. 393; *New Realism*, p. 475.

[3] Cf. *Present Philosophical Tendencies*, pp. 271ff.

these responses, and we call this principle consciousness, but we know only the manifestations of the principle. It is behavior that is observable and consciousness is merely the assumed metaphysical explanation of behavior; now the elimination of consciousness from our list of real beings is in accordance with the general tendency of modern science to eliminate non-empirical explanatory principles, essences, vital principles, etc., and to keep to the observable facts themselves. I do not wish to express an opinion on the behavioristic theory of consciousness, which has to explain away a good share of introspective experience before it can claim to be established. I merely wish to mention the fact that Perry suggests a definition of consciousness in terms of behavior in the course of stating the doctrine of epistemological monism. The two are not necessarily connected. The object which is the content of consciousness and the "real thing" may be one and the same, numerically identical, whether we define consciousness in terms of mental process or mental activity, according to the traditional notion, or whether we define consciousness in terms of physical response. And it is the former doctrine which is essential in realism.

The second thesis of Perry's "platform" is a denial of Berkeleian idealism. This denial of subjective idealism is of course what gives realism its name. Now while subjective idealism is, from the point of view of common sense, an extremely paradoxical doctrine, it nevertheless forms the key-note of a great deal of the thinking that falls under the more general heads of idealism and pragmatism. Subjective idealism may be briefly described as the position that the world exists only as the content or idea of consciousness. There is no external world, according to this doctrine, but only souls and their ideas. The regular order which we observe in our ideas, by which one idea tends to be followed by the same idea on each of its occurrences, is produced by the direct will of God working on our finite souls. There is no permanent tree which we can experience or perceive at different times and which different persons can experience or perceive; but God gives our ideas a certain regularity or order which causes us to believe falsely that there is an independent tree. As Schopenhauer said, the world is my idea, and the only difference between the real world and the world of dreams is the greater regularity and system to be found in the so-called real world. Such was the doctrine of the bishop Berkeley, who thought

to have found an invincible argument against materialism and atheism by denying the existence of a material world altogether.

Now subjective idealism, or this paradoxical reduction of the whole cosmos to ideas, is regarded by the realist as the cardinal principle of idealism. Hume was a follower of Berkeley whose radical empiricism led him to even more paradoxical consequences. Hume, in a word, abolished the soul (and tacitly God). He thus reduced the world to a chaotic stream of sense-impressions. And the philosophy of Kant, from which all modern idealism flows, is an answer to Hume. It consequently moves in the same world of thought in which Hume's investigations moved, and has certain deep similarities with Hume's system. For Kant the only world which is open to scientific investigation is what he called the world of possible experience, and not things as they are independently of us, i. e., things in themselves. Now it is clear that this is the system of Berkeley in a new form.

In Kant's system the world of possible experience, the world which constitutes the object of science, does not exist independently of consciousness. If no consciousness existed there would be no space, no time and no permanent mechanism of nature. Consciousness produces these things. In the first place, the sensuous world, colors, odors and sounds, etc., is relative to the sense-organ of the percipient. If there were no eyes, there would be no colors; no ears, no sounds; no noses, no odors. If our organs were different from what they are they would perceive a different world. But this is only the vestibule of Kant's idealism. Not only are the sensible qualities dependent upon the faculties of the perceiver, but the rational or logical form of the world is relative to the understanding of the thinker. It is we who arrange nature in space and time, and who subordinate it to a strict mechanical causality. Our minds read that into nature. Space and time, then, and also the categories of the understanding, causality, substance, necessity, etc., possess for Kant a subjective character. They are relative to the mind that thinks them.

The mind that thinks them, however, is not the private consciousness of the individual. Here we reach the distinctive characteristic of Kant's idealism. Kant begins by assuming the truth of mathematical science, especially as exemplified in the system of Newton, of which he was a great admirer. The truths of mathematics and physics are true for every one, valid for all minds. The

world of mathematics and physics, therefore, is an objective world in precisely this sense, that, namely, it possesses universal validity. Universal validity is in fact for Kant the very meaning of objectivity. Now if the world of mathematics and physics possesses universal validity, if its truths hold for all minds, then it cannot be the mind of the individual to which that world is correlative; it must be what Kant called consciousness in general, *Bewusstsein überhaupt*. Thus Kant is obliged to make use of the notion of a universal mind, to which all the phenomena of the world of space and time are relative. It is this notion of a universal mind which forms the central doctrine of what is called objective idealism. And it is objective idealism which most of the later idealists recognize as the only tenable form of idealism.

Objective idealism, then, or the doctrine that the world is relative to some sort of universal or cosmic intelligence, is an attempt to correct subjective idealism. If subjective idealism were true there could be no world of mathematics and physics with authority over all minds; each one of us could have a private arithmetic, geometry and mechanics. But Kant starts with the assumption of the universal validity of exact science. And he also assumes as part of his starting-point that what is known cannot be independent of the mind that knows it. This assumption is, as the realists have shown, the cardinal principle of idealism proper and is first clearly stated in the doctrine of Berkeley. It is this assumption which the realist makes bold to deny, thus affirming that what is known may be independent of the mind that knows it. It is obvious that in denying the root principle of idealism he has necessarily denied the more complicated and derivative form of idealism which is known as objective idealism. Objective idealism appeals from the individual mind to an assumed universal mind in order to maintain the universality of scientific truths. The realist has no need of the universal reason, for he does not admit that the world known in science depends upon or is in any way affected by the mind that knows it. Now Perry's second thesis is, as I have said, simply the affirmation of what may be called the cardinal principle of realism. "The specific response which determines an entity to be content of consciousness does not directly modify such entities otherwise than to endow them with this status. In other words, consciousness selects from a field of entities which it does not create. In its historical application, this implies the falsity of the Berkeleian and

post-Berkeleian idealism in so far as this asserts that consciousness is a general *ratio essendi.*"

So far we have merely the *assertion* of the realistic position. It is felt that the burden of proof rests on the idealist; hence, the argument for realism consists largely in the refutation of idealism. This is done by showing a number of fallacies which frequently occur in idealistic works. These fallacies the realist isolates and names, thus using the method by which Kant gave the death-blow to speculative theology in the Transcendental Dialectic of the *Critique of Pure Reason.*

The chief fallacies of which the realist convicts the idealist are those of definition by initial predication and of argument from the ego-centric predicament. The procedure of the idealist in the first case is very simple. He declares his intention of looking at the world from the standpoint of experience. This means that he proposes to regard the world primarily as an object of experience, in other words, as an idea, or perception. There is no doubt that the world is in part the object of experience; in other words, many things in the world are perceived or felt or conceived or imagined, in other words, experienced in some way. But for the idealist this aspect of the world, the world as an object of possible experience, the world as idea, is definitive. It is the very essence of the world to be a possible experience. In other words, the relation to consciousness belongs to the essential properties of the world. Now it has long since been observed that the "essence" of a thing depends upon the point of view from which you regard that thing. Thus a table presents a different character depending upon whether it is approached from the standpoint of physics or chemistry or biology, the latter regarding the table as essentially made up of wood from a certain variety of trees. The idealist regards the psychology of the table, the table as a perception, or as an idea, as the ultimate and definitive essence of the table. It is true that the table can very well be regarded as an experience or as a perception, but what the idealist has not proved and cannot prove is that the psychological way of approaching the table has any higher degree of ultimacy or absoluteness than the physical or chemical ways. He defines by initial predication; that is, he first regards the table as a perception and he then arbitrarily considers this one aspect of the table to constitute the true and absolute essence of the table.[4]

[4] Cf. Perry, *Present Philosophical Tendencies,* p. 126; *New Realism,* pp. 14f.

We may remark in passing that the whole tendency of realism is to deprive psychology of the falsely central position it has assumed. The realist arranges the sciences in a certain order, an order based on the logical dependence of one science upon another. Thus physics depends on mathematics, but mathematics is independent of and anterior to physics. Arranging the sciences according to this principle he gives the first place to the abstract and formal sciences, namely, logic and mathematics, the second place to physics, then comes chemistry, then biology, and lastly psychology as dependent upon all the others. Thus realism is opposed to psychologism, which would give the most complex and derivative science of all the position that belongs to logic and mathematics. But the reign of psychologism in American philosophy, whether as a part of idealism or of pragmatism, is only disputed by the realist.

The second fallacy pointed out by the realist in his attack on idealism is named the fallacy of argument from the ego-centric predicament. This argument is shown to occur in the system of Berkeley and also in other idealistic systems. The idealist draws an unwarranted conclusion from the ego-centric predicament in this way: To establish his conclusion the idealist calls on the realist to show him something which is not perception, experience, idea. The realist, perhaps, refers to the side of the moon which is never turned toward the earth. Here, he says, is something which is not experienced, and is not perception or mental content in any sense. There is no reason to suppose that any actual mind perceives the remote side of the moon. But to this the idealist replies: Ah, but you are thinking of the other side of the moon now yourself. You can't think of it without thinking of it; consequently even the other side of the moon is dependent upon consciousness. Now the ego-centric predicament consists in this undoubted but tautologous fact: that what you think of, you think of. The idealistic fallacy is to infer from this flat tautology that the opposite side of the moon, to revert to our example, exists only in consciousness. It is true that the realist is unable to think of anything which is not thought of by him at that moment, but it by no means follows that there are not many things in existence which are not content of any sort of consciousness.[5]

The realist, then, believes in the independent existence of an external world. But this doctrine is only the beginning of realism.

[5] Cf. Perry, *Present Philosophical Tendencies*, p. 128; *New Realism*, p. 11.

From a technical point of view the most important realistic theory is probably the external theory of relations. This theory too is negative, being a denial of the theory advocated by certain of the absolute idealists. The controversy between the internal and external theories of relation certainly constitutes one of the most fine-spun discussions in modern philosophy. And yet the point involved is easy to understand. For the external theory of relations is simply an endorsement of the methods of science in the face of anti-scientific criticism.

The internal theory of relations, as we find it in, say, Bradley, amounts to the theory that the world is an organic whole. Everything is related to everything else; nothing is isolated; and these relations are not accidental, fortuitous, to the things related but are essential, internal, to them. A thing's relations belong to its inseparable essence. Such is the doctrine of the idealist. He goes on, however, to say that if nothing is independent of anything else, then nothing can be known until we know everything else. This theory directly contradicts the independent and absolutely autonomous character of mathematics. It implies, moreover, that science follows a false path when it analyzes, abstracts, considers one thing at a time. It breaks up that which is by nature continuous, indivisible, and instead of mastering its object, only falsifies it. The scientist defines, examines his object now under one set of circumstances and now under another, and endeavors to measure the effect of each set of circumstances on his object. If, however, the world is a living organic whole, if everything in the world is inextricably bound up with everything else, then scientific analysis is impossible.

It is against this mysticism, this theory of the impotence of exact science, that Spaulding directs his thoroughgoing *defense of analysis.*[6] His essay is the third in the realistic treatise. In this essay he examines and, it would seem, refutes all of the current objections to scientific analysis. Not only is the so-called internal theory of relations of Bradley exposed but also the more or less obscurantist positions of Bergson, with their facile appeal to intuition. This discussion is, however, so technical that it would probably not be profitable to enter into it here. We may note, however, that it is the doctrine of the necessity of scientific analysis upon which the realist takes his stand in exposing what he is pleased

[6] Cf. *New Realism*, pp. 155ff.

to regard as a typical idealistic fallacy. The error of pseudo-simplicity has been one of the chief possessions of the idealists. This fallacy consists in arguing that because a thing is simple before analysis it must be so afterward. It confuses the immediate, first-hand simplicity of an experience, a simplicity which is simply the correlate of our ignorance, with the simplicity of that which is regarded as resisting further analysis on some rational grounds. The realist, in other words, takes a strong stand against immediatism. The immediatist appeals to his "immediate," unreflective experience, his "concrete" experience, and he regards this crude starting-point of knowledge as possessing higher authority than the same experience viewed in the light of scientific analysis and reflection. The realist finds, for example, that consciousness has been given a pseudo-simplicity. We are thought to have an immediate, intuitive, apprehension of our selves, our wills, our intellects, etc. Every attempt to analyze consciousness into simpler elements is met with the charge that consciousness is itself simple, unanalyzable, immediate; that we cannot reduce consciousness to its psychological elements without destroying its peculiar essence. The realist and the experimental psychologist, however, regard this apparent simplicity of consciousness as a pseudo-simplicity. Consciousness *seems* simple only because we have not tried to analyze it.

Another example would be *life*. The vitalist regards life as something ultimate, something which resists all analysis into terms of physics and chemistry. The processes of the living organism are thought to possess a unique and irreducible essence which transcends all varieties of mechanical interaction and chemical combination. The realist would regard life as possessing only pseudo-simplicity. It is simple to unreflective experience, simple in the concrete life of the unscientific. This immediate simplicity is, however, no guaranty that life is ultimately simple. On the contrary, the evidence seems to show that life is a peculiar resultant of certain highly complex mechanical and chemical processes. The realist would not deny the tautology that life is life, but he would insist that life is essentially a complex thing which can only be understood in terms of the simpler processes that go to make it up.

The realist thus takes his stand on the results of scientific analysis and reflection, upon the world as understood, as seen by the intellect, rather than the world as immediately given, that is, as it

It is his "conviction both that there is such a 'doctrine' difficult though it may be to discover what it is, and also that this doctrine is logically present in every attempt to philosophize rationally."[10] The system of realism thus consists in a set of ultimate logical postulates which are contained, whether implicitly or explicitly, in all attempts to construct a system of philosophy. It may very well be true that no thinker has yet presented, or even can at the present time present, an adequate formulation of these ultimate principles; their nature constitutes on the contrary the essential and unavoidable problem or task of philosophy.

The realist, however, is interested in the presuppositions of other systems of philosophy rather than in the presuppositions of the sciences, and herein consists his essential limitation. No doubt the realists have done much to reestablish that healthy correlation between science and philosophy which is always the sign of sound philosophy, but it is hardly to be denied that they have devoted the greater part of their energies to the technical refutation of other systems of philosophy. This work was necessary and has been well done, but the spirit of realism cannot rest with this result. It must rather advance to the consideration of the foundations of the sciences themselves. And in doing so realism will necessarily establish new relations with all those of the classical philosophers who have already labored on this problem. The problem of the logical foundations of the sciences is really identical with that of what Kant called transcendental logic. Kant's problem, in turn, was not a new one but was rather the perennial problem of the scientific tradition in philosophy. Plato, Aristotle, Descartes, Leibniz, Locke, Berkeley and Hume can all be studied with profit on the question of the logical foundations of science. Realism, in other words, must lay aside its spirit of youthful revolt from the history of philosophy and learn all it can from the great thinkers of the past. And, secondly, realism must press on to more detailed knowledge of the sciences themselves both in their historical development and in their present status. No single mortal can now hope to encompass the whole sphere of science, but a wise division of labor and concentration upon essentials can accomplish much. In this way a definite contribution will be made to the persistent problem of the logic of the sciences.

The system of ideal postulates which will be evolved will more

[10] *Ibid.*

or less adequately explain the history and present status of each of the sciences. It must not be thought, however, that this system of ultimate logical postulates will ever be brought, in the course of human history, to a complete and final formulation. The work of the criticism of science, like that of science itself, is essentially eternal. Each generation of thinkers must formulate anew its theory of science as well as its theory of everything else. And self-evidence can never be an adequate test of what constitutes a true scientific presupposition. What is self-evident to one may not be so to another. The philosopher must in the end rely on his concrete insight into science in its historical character. The presuppositions he seeks will evidence themselves by their efficiency in rendering science intelligible, in showing it as a unified system. A further development of science will therefore always demand a reconsideration of what were supposed to be the ultimate logical foundations of science. Thus the evolution of systems of non-Euclidean geometry was profoundly significant for the philosophy of mathematics, while the recent Einstein-Minkowski theory of relativity in mathematical physics will no doubt involve far-reaching changes in our notion of what physics is.

Realism, then, has practised an effective criticism upon the more or less frankly anti-scientific doctrines of idealism and pragmatism (speculative theology and skeptical relativism) and has itself made some start in understanding the logic of the sciences. Spaulding's critical attitude toward the concepts of substance and causality, the bulwarks of the Aristotelian logic, is, as may be safely said, a decided step in the understanding of the mathematical sciences. Nevertheless, granted that realism is to have a continued development, is not its line of growth in the direction of a more inclusive appreciation of science as it actually exists and of the classical philosophers in so far as the latter have worked on the theory of science?

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FREEDOM IN THE WORLD-SOUL.

A PLEA FOR BERGSONIANISM.

"There is only one thing stronger than armies; it is the Idea, when its time has come."—Victor Hugo.

The ideal goal toward which mankind has been striving in its effort to realize itself has been the complete unification of the race and the attainment of perfect freedom. All progress in civilization may be regarded as so many stages of advance toward this goal, and if we accept the Bergsonian view of matter evolving under the urge of the vital impetus, we may say that the whole course of developing life illustrates the same progress and points definitely to the same goal. Why has the goal not been reached? Why has our civilization, apparently at its highest point in material achievements and in thought, gone bankrupt? Why did it culminate in the terrible world catastrophe which has just inflicted upon humanity such appalling losses of life and treasure?

It is imperative at this juncture to take stock of humanity's possessions, to make an inventory of its assets, if we are to know why it has failed to meet its liabilities in the past and how it is to discharge its debt in the future.

On the material side, our civilization boasts unprecedented wealth, the product of man's brain and brawn. Have the stores of material riches helped to stabilize human destiny and life, and have they furnished proofs of their intrinsic value? The lesson is quite fresh. They were drawn upon to provide the very weapons for mankind's destruction. Material progress, while undoubtedly contributing much to the amelioration of social conditions and the preservation and enhancement of life, has fallen short of equity, inasmuch as it lacked the power to assure humanity's permanent freedom.

In the realm of the intellect, apart from science, the handmaid of material progress, what has been the contribution of philosophy with its vast heritage, ancient and modern? Man has speculated upon the why and the wherefore of this world ever since he began to think. The quest for the world-soul has extended through the ages—from Plato with his Idea—the pre-Christian knight of the Holy Grail, to the Good-Will of Kant, rising from its solid foundation of time and space, to the ever-present, yet ever-eluding Abso-

lute of Hegel, to the Will of Schopenhauer, encircling within its steel ring the will-o'-the-wisp of human existence, to Nietzsche's Zarathustra, dancing with his shadow. All contributed their quota to the heritage of intellectual aristocracy. Each and all left a distinct trace upon human thought, yet were powerless to stay the disaster which has overtaken mankind.

Prince Troubetskoy,[1] after reviewing philosophical progress, comes to the conclusion that, though always revolving upon itself, philosophy has failed to provide a pivot for human destiny.

Thus far, then, neither material wealth nor intellectual heritage has been able to set mankind free. Will not the awakening social conscience, together with the gradual realization of their power by different social groups, bring in the millennium along social and industrial lines? And labor movements, socialism with its various ramifications—are they not able to accomplish humanity's complete freedom? Under present social and industrial conditions, with their incentive of material reward, their motive power the struggle for existence, the awakening social conscience must needs rely on force for the gradual curtailment of the privileges of the few in the interest of the many. We hear much nowadays of the new democracy. Never before in the history of mankind, with monarchies tottering to the ground, have the masses of the people so asserted themselves, have the workers of the world so eagerly pushed forward to seize on what they think is their rightful due. The old world is passing away, and before our very eyes the new world is being born. In this new democracy the worker will call for a larger and larger share in the product of wealth, with a corresponding curtailment of capital's power. Will labor stop short of dispossessing the capitalist, or will it dispossess him, as Marx taught it should? What if capital is finally overthrown? Will that bring in the millennium, obliterate all strife, achieve full equity, lead to man's complete and perfect freedom? The example of the Bolsheviki is before us for an answer. A thoroughgoing social reformer may object on the ground that the Bolsheviki are bunglers, that under better leadership, a better state could be evolved. Grant this. There may be better-ordered and better-adjusted socialistic communities. Will they be able to liberate mankind by substituting emulation for the present-day incentive of material gain? Will emulation offer a strong enough incentive? Will it knit humanity together into one whole?

Neither material progress, then, nor philosophic thought, nor

[1] *Hibbert Journal*, April, 1918.

social and socialistic reforms have proved themselves adequate to bring in perfect and permanent freedom. Our civilization has failed and gone bankrupt because of the very fact that it was founded on force, and just as long as force is its motive power, it will fail to reach the goal of the unification of mankind and the achievement of perfect freedom in the world-soul.

What is meant by the world-soul? It does not mean the merging of all human minds into a single mind, for that would signify the closing-up of all human beings into a single organism. It means that, while preserving its separate individualities, mankind shall be so unified and harmonized in purposes and ideals, that it will be able to hold them before it as a common goal and work toward their realization as a common end to be reached. In this sense the world-soul will be the sum of all human souls bound together by a common aspiration for the highest good, and seeking to bring it about by a concentration of thought and will. In harmony there is cooperation; in union there is strength. The individual soul, faced by conflicting and divergent wills, can do little or nothing. The world-soul, made up of concurrent and converging wills, with its motive for effort a grand ideal to be realized, will be able to "move mountains."

But how is humanity to evolve a world-soul? Just as sense-organs develop under the influence of external stimulus (light, for example) and in response to the need of the organism, so humanity will develop new transcendental powers under the influence of spiritual incentive and in response to its need. The goal to be reached, the world-soul, will be evolved by the unification and spiritualization of mankind, by the welding together of all life.

Bergson says: "All living beings are connected, and all yield to the same formidable thrust (*élan vital*). The animal is supported by the plant, man rides the animal, and the whole world of humanity in space and time is an immense army galloping by the side of each of us, before and behind us, in a spirited charge which can upset all resistance and leap many obstacles, perhaps even death."

The upward movement toward spiritualization and unification has characterized life and especially human life from its earliest beginnings. At first the organism is little more than an object responding physically to the influences that flow in from the environment. Gradually, as human, it acquires the power of mould-

ing that environment to its needs. A relation between the individual and his society is set up. Speech is a social product, and human thought itself is largely a social product. Men think in common. What is needed is that they shall act in common for great common ends. Hitherto this common action has been mainly on the material plane. The time has now come to unify mankind with the aid, not of physical forces, but by resort to the psychical powers which are possessed by each individual. It has been abundantly shown[2] that thought is accompanied by emanations which pass out from the brain rhythmically into the ether, set up vibrations in that medium, and are capable of influencing matter at a distance, other human brains included. The trouble with the use of this power is that it is exerted individually and for the most part unconsciously; through the conflict of individual wills, each aiming at different ends, the influence is dissipated or wastes itself in mutually opposing currents. What is needed is that it shall be organized and used consciously in the interests of human welfare. To make this possible, men must be spiritualized into sympathy with each other to such a degree that they will acquire the unity of purpose and the harmony in action which are needed for the putting forth of a common will. When put forth by a humanity thus joined together for common effort, the psychic power which it can wield will be nothing less than transcendental. For it is of its nature to go out in rhythmic waves, and rhythm, it has been shown, is the inner mode of all nature forces. The ether trembles rhythmically, the light-vibration moves through it rhythmically, all changes in nature and in life are rhythmic, from the ebb and flow of the ocean to the fluctuations of finance and the vicissitudes of supply and demand. Music, art, progress itself, all furnish illustrations of the mode by which all things change and advance. The universe pulses rhythmically, and it is by adapting ourselves to its rhythm and by utilizing it that we may share in the Divine power and become "coworkers with God."

But humanity must be spiritualized. Its need in this respect explains the influence of Bergson's philosophy with its accentuation of duration. For what is duration but rhythm at work in the universe! Bergson's method, we take it, represents transposition from one plane of existence to another by means of rhythm. Mendeleyeff's periodic law holds good not only as regards matter, but in

[2] Cf. the article, by the writer, "Mind, the Creator of Matter," *The Monist*, April, 1918.

relation to the whole of life, which rises in ever-ascending scales from the lower forms to the higher, attaining its culminating point in man, but not stopping there. For man's divine birthright, his soul, must forever urge him on to his goal—his union with God.

How shall we view this transposition? Tarde says that all spatial likenesses are due to likenesses of vibration; consequently, every form of matter and life has its rhythm. The Zen teacher propounds questions: to answer them the student must dip his personality into the universal rhythm; he must become a pebble on the seashore, or a blossoming tree, a mountain torrent, or, perhaps, his own hand.

According to Bergson, "absolute revelation is only given to the man who passes into the object, flings himself upon its stream and lives within its rhythm."[3] And further on, "The philosopher [must] not keep at a distance from things, but listen in a manner to their inward breathing, and above all, supply the effort of sympathy by which he establishes himself in the object, becomes on intimate terms with it, tunes himself to its rhythm and, in a word, lives it."[4] And Bergson's "effort of sympathy" we take to mean no less than the law of unity and harmony underlying the whole creative process. In illustration of the manner in which we can transpose ourselves to another scale of existence from the ordinary one, we may cite the example of seeing the voice of a singer, for it is now possible, by means of electricity, to make sound-vibrations visible and to follow the flow of voice-waves on the screen. So might we, were our beings sufficiently attuned, hear the Sistine Madonna.

In interpreting the philosophy of Bergson, Le Roy says:[5] "The new philosophy desires to be a proceeding, as much as, even more than, to be a system. It insists on being lived as well as thought. It demands that thought should work, at living its true life, an inner life related to itself, effective, active and creative, but not on that account directed toward external action. 'And,' says M. Bergson, 'it can only be constructed by the collective and progressive effort of many thinkers and of many observers, completing, correcting and righting one another.'"

But is not such a philosophy of thought and inner life outside the pale of external action, foredoomed by its own nature to remain chiefly in the domain of metaphysics, exotic fruit for the enjoyment

[3] Le Roy, p. 41. [4] *Ibid.* [5] *Op. cit.*, p. 23.

and degustation of the select few, but not palatable and within reach of the hoi polloi? The principle, to be vital, must be capable of universal application. Is there not any common ground upon which all, high and lowly, could meet?

That Bergson's philosophy reaches the core of the subject is without doubt, for it aims at the spiritualization of mankind, and is intrinsically related to man's future progress and destiny in the light of creative evolution. But it admits of reinterpretation and alignment with external action and life. That is to say, Bergson's philosophy must be supplemented by a concrete system of metaphysics such as Prof. James thought of writing not long before his death. Such a system contemplates the union of science and religion into one cult that would work for the greatest benefit of mankind.

Bergson's stress upon knowledge as a part of active life is of the greatest importance. In this he strikes at man's Achilles heel. Humanity has failed for the reason that its knowledge, embodying all its philosophy and science, has not represented the whole of its active life. Men, with perhaps a very few rare exceptions, have not lived and died by knowledge, for it lacked the spiritual incentive. On the other hand, men have lived and died by religion, just because it had the spiritual incentive. Our knowledge must unite with religion in one cult and must become an integral part of life. The spiritual incentive would be offered by the share man would take in creative evolution, for he would have power to create his own world; his greatest incentive of all would be supplied if he could realize that he could at last, as Bergson intimates, overcome death. For man's complete freedom will not be accomplished until he overcomes death.

Freedom, properly understood, is not a matter of legislation. Underlying it are the fundamental laws of man's spiritual development. And the "riddle of the Universe" can only be solved in the light of an ideal which should offer a working incentive to the race.

Humanity is beginning to grasp all this. Slowly it is coming to realize that our civilization lacks the spiritual incentive. Hence the trend of modern ideas in the direction of idealism and a spiritual interpretation of the universe.

Humanity at the crossroads eagerly listens for an answer to the "Quo vadis?" listens to Bergson who speaks of freedom for man to create his soul, to Boutroux who tells of freedom from the fiat of nature's laws.

The cocksure materialism of the last century, which aimed at the reduction of all spiritual phenomena to the interaction of matter and force, is generally discarded by modern thinkers, and the very science which upheld it formerly now furnishes weapons for its downfall. In the latest view of the ultimate units of power as "electrons" and the modern explanation of all energy phenomena as electrical, matter disappears, and is accessible only to idealistic conceptions. Nor does the theory of psycho-physical parallelism avail to establish the claims of materialism. It fails utterly to explain consciousness: all it can do is to proclaim the concurrence of psychical with physical phenomena. The two occur together, but why, is beyond its power to explain. No matter how much we attenuate the brain-tissue, we are unable to locate thought—the spiritual emanation of man's bodily frame—or put a finger into man's soul, his divine inheritance.

Thus, far from being void and purposeless, the world is athrob with the universal soul which humanity has for so long sought and which now comes within its purview. Bergson's *Creative Evolution* sums up this effort on the part of humanity to evolve the world-soul. As interpreted by Le Roy, Bergson voices the ethical implications of this aspiration in the words: "In the depths of ourselves we find liberty, in the depths of universal being we find a demand for creation. Since evolution is creative, each of its moments works for the production of an undeducible and transcendent future. This future must not be regarded as a simple development of the present, a simple expression of germs already given. Consequently we have no authority for saying that there is forever only one order of life, one plane of action, only one rhythm of duration, only one perspective of existence.... Taking life in its first tendency, and in the general direction of its current, it is ascent, growth, upward effort, and a work of spiritualizing and emancipating creation; by that we might define Good, for Good is a path rather than a thing."

It is just this path which is represented by unified and harmonized human thought, but in order to take it humanity must be spiritualized, so joined as soul to soul, each a unit of good, the many completing the one, the one recruiting the many, that the irresistible force of all minds and wills shall be able to refashion the world and achieve even immortality itself.

But is not this setting all nature's laws at naught, a fantastic dream, a *reductio ad absurdum*? For proof to the contrary we must

turn to the experience of mankind, reenforced by the dicta of science itself. Is immortality impossible of achievement? The belief in life after death is fundamental in the human race. Professor Hyslop, in his recent book *Life After Death,* traces it from its beginning in savages, through the Greco-Roman and Christian epochs up to modern times. In the final analysis, the belief in after-life is the belief in man's immortality, for if man is possessed of an immortal principle, its operations cannot be confined to life after death but must be inclusive of all his existence. This should mean, it may be urged, that he lived before. He did, in an undifferentiated state, far antedating the evolution of his consciousness. Science tacitly admits it. Weismann and other biologists have established the immortality of the germ-plasm, showing that it is carried down from generation to generation, independently of the soma or body that grows up around it as its servant. From this viewpoint the vital principle is inherent in cell-structure, in organic molecules, even in matter itself. And all chemistry, as Mendeleyeff pointed out, may be reduced to the operation of the physical laws. In this connection the law of the conservation of energy has a direct bearing on immortality, for its operations cannot be restricted only to the conservation of physical energy, but must include also the conservation of man's psychic forces. It is absurd to think that the very culmination of the whole creative process—man's personality—should be doomed to disappear in a void. Professor Hyslop says:[8] "There is another argument of much force which the scientific mind will have to respect as long as he interprets the conservation of energy as implying the persistence of the antecedent in the consequent of the causal series which he studies.... You cannot say that the effect, consciousness, is a mode of action without assuming that the antecedent motion is also consciousness, or your conservation of energy does not hold good."

The import of this approximation toward a spiritual interpretation of the cosmos is apparent. Thus we can see that physical laws can be drawn upon in support of man's immortality. Nor does physiology offer insuperable obstacles to this view. The laws of chemistry are such that continued life is only a question of keeping up the equilibrium between the assimilation and dissipation of energy, between waste and repair. In this way the colloidal cell of the organism would be virtually immortal were it maintained

[8] *Life After Death,* pp. 171-72.

in a state of stable equilibrium. Disease and death are results of a breaking-up of this equilibrium: the colloidal cell loses its elasticity and its curve. Why should the maintenance of the curve be of such importance? Life is coming more and more to be regarded as nearly related to electricity, with the human organism viewed as a sort of storage battery. The flow of vital force is directly dependent on the structure which itself has fashioned. According to Dr. Spear (*The True Undulatory Theory of Sound*), the conchoid of sound-waves exactly corresponds to the conchoidal form of the ear, and even to the form of the vocal organs. The inference is plain: the organs were shaped by the sound-waves themselves.

Do we really set nature's laws at naught in reasoning thus about man's power to achieve immortality and to create his own world? Hear what Boutroux says at the close of his book on *The Contingency of the Laws of Nature*: "The laws of nature have no absolute existence; they simply express a given phase, a stage, a moral and esthetic degree of things, so to speak. They are the image, artificially obtained and determined, of a model that in essence is living and movable. The apparent constancy of these laws finds its reason in the stability inherent in the ideal itself.... In proportion as beings that cease to live solely for themselves and as the subordination of the lower being to the higher, the inner adaptation of the conditions to the conditions of matter and form, becomes more spontaneous and complete: in like proportion do we find a diminution throughout the world of uniformity, homogeneity and equality, i. e., of indisputable sway of physical fatality. The complete triumph of the good and the beautiful would do away with the laws of nature, strictly so called, and would replace them by the free flight of human wills toward perfection, by the untrammeled hierarchy of soul."

According to Boutroux, therefore, man is free, under the stimulus of the good and the beautiful (which is only one way of expressing the operation of the laws of unity and harmony manifest throughout the cosmos) to evolve his own laws. It should be clear, then, that "nature's laws" cannot be pleaded against man's attaining immortality in his present existence.

The manner in which man shall achieve immortality, whether by retaining his present organism, by means of advance in knowledge and science, or by divesting himself of his frame altogether

and evolving some other vehicle for his personality, more in accord with his higher spiritual nature, we may safely leave to the future and repeat with Bergson that we have no authority for saying that there is forever only one order of life, only one perspective of existence. Humanity's chief concern, moreover, lies in the realization that "the theory of knowledge and the theory of life are bound up with one another";[7] that "all philosophy is a soul, a mind, and begins with the simple unity of a generating intuition";[8] above all, that

> "All are needed by each one—
> Nothing is fair or good alone."

The process of cosmic unification manifesting itself through matter and in all forms of life, the human organism and man's racial and social development included, has reached a stage in which "the principle of good that is in the universe," as Paul Janet puts it, "must be not only conserver, but promoter, originator, creator." That is to say, the psychical powers of mankind—the thought and will of human beings—must unite in accordance with the laws of unity and harmony to bring about the evolution of the world-soul.

But is such a process feasible, and are there any reasonable grounds for believing it practicable? The first reason is that it is a spiritual process: it assumes spirit as fundamentally at work in the universe. For it is only in the light of the spiritual hypothesis that we can rationally comprehend the cosmos at all. All other hypotheses, whether materialistic or idealistic, leave no ultimate avenues for human thought: they swing us around a circle or land us inevitably in a cul-de-sac.

This process is in line with both science and logic. It assumes man beginning with matter not yet organic, and gradually rising through lower forms of life to be finally both conscious and self-conscious. In the nature of things man is unable to look back to his primordial state, but the power of consciousness which he has acquired confers upon him the vision of his goal—union with God. In achieving the goal, man will also encompass the beginning.

Also, progress toward the evolution of the world-soul is implied by the Biblical account of creation. According to the Scriptures, God, the Spirit, first created the elements, which He separated into land and sea; then He created different forms of life, beginning

[7] Le Roy, *op. cit.*, p. 115. [8] *Ibid.*, p. 139.

with the lowest and ending with human beings. Man was thus the final stage of the creative process. God created man in His image —perfect. God's perfect world was under the operation of the laws of unity and harmony. There was no strife in it; no death and no toil, that is to say, no struggle for existence. With the fall of man the original conditions were reversed (through the breaking of the laws of unity and harmony) and the world came under the sway of brute force with its concomitant, the struggle for existence. (In this connection, Professor Soddy offers a very pregnant speculation in his book on *Radium.*)

The greatest reason, however, for believing that a world-soul can be evolved is the spiritual incentive which it would offer to mankind. It is not the incentive of material gain at present actuating man, and not the incentive of emulation substituted for it by the social reformers, but only the spiritual incentive, with its goal of all-power and perfect freedom in immortality, which can transform the world. The instinctive longing for immortality, correlated with the horror of bodily dissolution, is deeply implanted in the human soul; there can possibly be no stronger incentive to moral perfection than the desire for immortality.

Nor is there anything in man's effort to achieve immortality that would controvert the teachings of religious belief. According to the Biblical account, man was created perfect, that is, invulnerable to death and disease. Through breaking the laws of unity and harmony, he lost his perfection and became mortal. By inference, as soon as he regains his perfection ("Be ye perfect"), he will reestablish the operation of the laws of unity and harmony, become immortal and evolve a perfect world.

For ages we have had the light of "Glad Tidings" to illumine our way, yet humanity still fails to grasp the full import of the Divine message!

The bodily resurrection of Christ, which constitutes the cornerstone of our Christian faith, furnishes a sublime example of the triumph of the Divine over merely physical laws, and if we are no less consistent in accepting the data of modern science than we are in believing the dogmas of Christianity, we shall inevitably regard the principle of man's immortality as being in agreement with both our Christian faith and with the postulates of modern science.

One advantage of the conception of a world-soul, as a spiritual

incentive to effort, lies in its intelligibility for the general mind and for humanity at large.

Professor Hyslop says:[9] "If philosophy is to have any legitimate function in the world, it must be convertible into the language of common life at some point of its meaning. No doubt, it has its esoteric aspects and that it cannot be understood as a whole by every one. But it is not a true philosophy unless it touches life in some general doctrine or belief."

Man's desire for immortality, apart from the instinct within him, has ethical implications that devolve upon him as a part of the existing order, which operates on the basis of brute force under the lash of the struggle for existence. All creation groans under it; war, pestilence, strife decimate mankind. The dumb animal world, with its untold agony and woe, is trampled underfoot. But the struggle for existence is merely a passing stage: the perfect world will know it not. Yet that world is not perfect in which the tiniest life is under stress. Collectively we are all responsible for the existing inequity. As society first produces the criminal, then punishes him, so every individual is responsible for the disasters that overtake mankind and for the aggregate misery of the world. Every individual soul of us is responsible for the solvency of our liabilities as spiritual beings, as a power for good.

Nor would humanity need in a perfect world to wrestle with the problem of evil which confronts it now. For that problem was fundamentally settled by the Scriptural edict which forbade man to taste of the fruit of the knowledge of good and evil. In the lower world of life the problem does not exist: guided by its instinct, the animal does only right, since instinct knows no wrong. To know no evil is not to do it. This principle underlies all education and training. St. Augustine gave a correct solution of the problem of evil when he negatived it by affirming that evil was "not doing good." The argument that all our knowledge is by antithesis, that we know the good only because of the existence of evil, is basically incorrect: evil subtracts from the knowledge of good, but does not add anything to it. In reality there is no antithesis. Science is explicit on this point. Below and above the spectrum accessible to human vision there are rays the eye cannot see; below and above the sounds we hear there are sound-vibrations which the ear cannot perceive. So the argument that all our knowledge is by antithesis

[9] *Op. cit.* p. 316.

has no validity. What is meant by antithesis is simply a lack of spiritual vision and sense. The values being transposed to the higher scale of existence, evil will automatically disappear from a perfect world.

Professor Hyslop writes: "Immortality has ethical implications when other theories of consciousness and its destiny have none. All theories either directly or indirectly favoring materialism or its equivalent, whether called idealism or not, do not satisfy ethical postulates in regard to the value placed upon personality or the ethical impulses in our very conceptions of morality, as it requires the future for the realization of its ideals. Man will always place ethics above everything else."[10] "All ethics are based upon hope and this because no action of the will whatever is rational without an end which always requires the future for realization of it, and we must be assured that the law of nature allows of that fulfilment. Hope is therefore as much a part of the cosmic scheme as is any interest in the past or the present. No science or philosophy is complete without taking it into account."[11]

Man will always place ethics above everything else because he instinctively feels that in his moral perfection and righteousness he has a path, the only path by which to reach God, and through God and in God, to achieve all power—to become divine. This is the meaning, we take it, of Bergson's intuition.

Like a caged squirrel, man for ages has been running round and round within the wheel of life. Has not the time finally come for him to realize himself as a free being, with all that freedom in the world-soul implies?

Ralph Waldo Emerson says in his divinity school address: "I look for the hour when that supreme beauty, which ravished the souls of those Eastern men, and chiefly of those Hebrews, and through their lips spoke oracles to all time, shall speak in the West also. The Hebrew and the Greek Scriptures contain immortal sentences that have been bread of life to millions. But they have no epical integrity; are fragmentary; are not shown in their order to the intellect. I look for the new Teacher that shall follow so far those shining laws, that he shall see them come full circle; shall see their rounding complete grace; shall see the world to be the mirror of the soul; shall see the identity of the law of gravitation

[10] *Op. cit.*, p. 324.

[11] *Ibid.*, p. 332.

with purity of heart; and shall show that the Ought, that Duty, is one thing with Science, with Beauty, and with Joy."

Prince Troubetskoy,[12] after pointing out the inadequacy of philosophy to solve the question of human destiny, sees man's salvation, as of yore, in the Saviour's Cross, with its lateral line representing earth and its vertical line pointing to heaven. In other words, humanity can reach its goal only in the light of a divine ideal which will supply a working guidance to man on the plane of his earthly existence.

What the world needs is a reinterpretation and spiritualization of all life and civilization. New values should be set on man's personal responsibility as a unit of good. Above all, our knowledge must become our life and at one with religion.

Humanity's most sacred duty, as the guardian of its own future, is to train and rear the new generations in accordance with this spiritual revaluation of man's place and end in the world. Thus far humanity has failed because it lacked clarified vision, spiritual insight and organization. If man is to be freed from the shackles that bind him, and all creation liberated from brute force, the spiritual incentive must sway all human minds until the world-soul becomes a reality. Then, and only then, shall we in truth become "coworkers with God."

Bergson says: "The true metaphysics will be an immediate vision of reality and the mystical experience is certainly that."[13]

Those to whom the spiritual experience was vouchsafed know that the Spirit liveth, for they felt its presence in the transcendental beatitude of the soul before which pale all earthly joys. Some writer has said that could all men but realize it, none would be left to live this life.

Were Nirvana to be the final solution of man's destiny, this world would vanish in a trice. It exists only in virtue of its goal and by the grace of man's redeeming faith.

"And I saw a new Heaven and a new earth."

L. L. PIMENOFF.

BOSTON, MASS.

[12] *Loc. cit.*

[13] Quoted by Macintosh in "Bergson and Religion," *Biblical World*, January, 1913.

LORD RAYLEIGH.

1842-1919.

The death of John William Strutt, third Baron Rayleigh, closes the roll of the Victorian mathematical physicists. Descended from a family that settled in Terling Place in the late years of the eighteenth century, his life was a serene and successful one. He had no obstacles or difficulties in the way of a career to overcome, but the family motto, *Tenax propositi*, finds fit expression in the tenacious, ordered effort of his life.

John William Strutt was born at Langford Green in Essex on the 12th of November, 1842, and went to Trinity, Cambridge, in 1861. He was Senior Wrangler, Smith's prizeman, and was elected Fellow of Trinity in 1866. The next landmark in his life was 1873, when he was chosen a Fellow of the Royal Society and succeeded to the barony. In 1879, when on the death of Clerk Maxwell the Chair of Experimental Physics fell vacant, he was elected to the position, which carried with it the directorship of the Cavendish laboratory, which he held for five years. Though busy with his own scientific pursuits, Lord Rayleigh set himself to develop its possibilities for students, and organized a system of invaluable practical teaching in experimental physics. The great increase in the popularity of the Natural Science Tripos at Cambridge is in no small measure due to his efforts. In 1884, he was President of the British Association, and in 1887 he succeeded Tyndall as Professor of Natural Philosophy at the Royal Institution, a position he held until he was made President of the Royal Society in 1905. A year later he became Chancellor of the University of Cambridge. His honors were many, and among them he received the Order of Merit, and the Nobel Prize for Physics. He died on the 30th of June, 1919.

Apart from his necessary activities as a landowner—he was a purveyor of milk to London and an enlightened agriculturist—he is chiefly known to the world as the discoverer of argon. That discovery does not exhaust the sum of his contributions to science, which may be measured by the five volumes of his collected papers (1869-1910), printed by the Cambridge University Press, and bearing the motto: "The works of the Lord are great, sought out by all that have pleasure therein." These papers—three hundred and forty-nine in all—fall into three main divisions, on sound, on optics,

and experiments to determine certain fundamental physical constants. Among these are scattered lighter efforts, *parerga* such as a paper on pinhole photography, on "Mr. Venn's Explanation of a Gambling Paradox," and "Insects and the Colours of Flowers" (Vol. I, pp. 336 and 222). In 1871 he published an important series of papers on optical questions, including the theory of the scattering of light by small particles, and its application to explain the blueness of the sky. He found time to determine, by means of exact and patient experiment, certain fundamental quantities in electric measurement, the value of the ohm, the electromotive force of the Clerk standard cell.

In his address to the mathematical and physical section of the British Association in 1882, he had affirmed his conviction that the time had come for the redetermination of the density of the principal gaseous elements, and said that he had already made some preparation for this work, which occupied him for more than a decade after he had left the Chair of Physics at Cambridge in 1884. Having obtained satisfactory values for oxygen and hydrogen, he turned to nitrogen, and discovered certain baffling discrepancies in a given volume of nitrogen extracted from the air, as compared with the same volume obtained by chemical means from nitrogen-containing compounds. He was led to the conclusion that nitrogen extracted from the atmosphere was contaminated with an unknown, inert, heavier element, which he named argon. This valuable and most widely known of his discoveries witnesses to his meticulous accuracy and perseverance. His scientific work never blazed into a single flare of notoriety; and though useful, it never reached a great commercial success. He was not a great inventor, but he increased the range of fog-horns. His work is characterized by finish, skill, competency, even elegance, *style,* in fact. Much of it was critical in essence, and consisted in the filling in of gaps or the removing of obstacles in other men's investigations, the labor of the file, the final process of polish to theories roughed out by others. He has been truly said to be rather a critic than a creator, and a man with a lesser share of scientific imagination than the two great Victorians, Kelvin and Maxwell.

BOOK REVIEWS AND NOTES.

MODERN SCIENCE AND MATERIALISM. By *Hugh Elliot*. London and New York: Longmans, Green and Co., 1919. Pp. 211. Price $3.00.

"The main purpose of the present work," the author says (pp. 137f), "is to defend the doctrine of materialism. It is, indeed, a materialism infinitely different from that of the ancients, for it makes vast concessions to agnosticism, and it concedes the whole foundation of knowledge to idealism. Yet it remains materialism; for I shall endeavor to show that the whole of the positive knowledge available to mankind can be embraced within the limits of a single materialistic system."

Taking the position that all true philosophy must be based on the facts of science, the author devotes the first three chapters to a résumé of the chief conclusions of astronomy, physico-chemistry and biology, under the headings "The Universe as a Whole," "Matter and Energy" and "Life and Consciousness." A chapter on "The Fallacy of Vitalism," largely concerned with physiological questions, ushers in the philosophic part of the book proper, one chapter on "Materialism" and one on "Idealism." The last two terms are not intended to designate two rival doctrines—in the author's words (p. 14), "the old antithesis between materialism and idealism vanishes completely....they are one and the same doctrine, looked at from different aspects and stated in different words."

On the whole, the author's philosophy may be described as an adaptation of the work of Ernst Mach, for while he tries to define his position over against that of Bertrand Russell and especially that of William James (p. 15). it is apparent that all his major theses are contained in the teachings of the great Viennese positivist. Needless to say that this detracts nothing from the value of the book—on the contrary, for Mach's views will be worth spreading for at least a hundred years to come.

If we have any fault to find with the volume before us, it concerns a gap rather than any positive statement, for we find nothing adequate said about the mind-brain relation. The third chapter deals with consciousness only in a few preliminary paragraphs, leading up to the assertion that certain "specific physico-chemical reactions of nerve tissue....actually *are* consciousness, in precisely the same way that the specific reactions of protoplasm actually *are* life" (p. 102). Similarly we read on page 122: "What *is* a state of consciousness? The untrained mind will, of course, immediately hypostatize it, and call it a *thing*. Let us, however, call it a process, and instead of regarding it as a

thin and shadowy accompaniment of certain cerebral processes, let us boldly identify it with those processes, and say that it is one and the same." For proof we are in both cases referred to the final chapter. Now we may be in complete accord with the author's theory, but having read his book from cover to cover we cannot see where he has proven it.

If we identify consciousness with certain cerebral processes, the fact remains that here are two aspects of one thing x—to be explored by psychology and the physiology of the nervous system respectively—whose mutual relations seem to be a subject of legitimate inquiry. It is precisely on this question that the author fails to enlighten his readers, the very problem on which the metaphysics which he condemns is thriving to this day. There is not a word in the book, e. g., about Richard Semon's theory of the *mneme*, particularly as applied to the nervous tissue, though on the other hand we find nothing in it, either, to bar the author from accepting this theory. As things are, his own views come dangerously near to inviting the charge of epiphenomenalism (cf. pp. 189f), for if no relation is established between consciousness and cerebral processes, and we can hardly doubt the objective quality of the latter, what else can consciousness be but their despised "accompaniment"?

A few words might be said about the author's polemics against "the confused idea of things existing 'in themselves' as apart from the way in which they appear to us" (p. 181). On page 4 we read: "If, then, all knowledge and all imagination is based on sense-impressions, it is clear that our notion of the universe is bound to remain forever of the most incomplete possible character. Supposing we had a few more senses, how very different everything would appear....To a being thus endowed, the philosophy of a mere human being must appear indeed primitive....Yet, though it would so vastly exceed ours, the intellect of even this being would be no nearer than *we* are to the ultimate mysteries of existence....," and so on and so forth. We must leave it to the author to reconcile these two statements; suffice it to say that Kant is *not* touched by his attack. X. B. N.

THE INTUITIVE BASIS OF KNOWLEDGE. By *N. O. Lossky*. Translated from the Russian by *N. A. Duddington*. London: Macmillan & Co., Ltd., 1919. Pp. xxx, 420. Price, 16s. net.

This work of Professor Lossky falls into two parts: the first, a summary of the problem of knowledge in modern philosophy which is mainly critical, and an examination of the systems of pre-Kantian empiricism and rationalism as presented in the systems of Locke, Berkeley and Hume; the second, Professor Lossky's own solution. He finds the same defect in all the attempts to solve the epistemological problem, which is "the assumption that the knowing subject is isolated from the known object." If knowledge and the known object are isolated from each other, knowledge can only correspond to the known object in the sense that in knowledge a more or less perfect *copy* is found of the known object. But if knowledge is a copy of an original which is external to the process of knowing, experience certainly does not provide us with any criterion for determining the degree of correspondence between the copy and the original. "Indeed, in this case, there are no conclusive grounds for affirming such a correspondence" (p. 31). Consistently carried

The remaining chapters deal with man in various aspects, and three chapters are given up to religion as a formative factor.

Professor Macfarlane does not hold the view that religion and science occupy spheres and pursue methods that are largely opposed to each other; he believes that God is the great ultimate energizing unity of the universe, which may be discovered by man, just as the laws of nature are discovered; while he regards Christ as "one and only one of those great human prophets or proenvironers who have successively appeared during the past ten to twenty millennia." A word is necessary here as to the "Law of Proenvironment," an unfamiliar phrase (Chapter IX), defined by Professor Macfarlane as "the capacity of an organism for perceiving and then positively growing or moving toward an environment that is most satisfying to it," which appears to owe its origin to his taste for innovations in scientific phraseology. As may be seen, Professor Macfarlane presses science and religion, sociology and ethics into this massive contribution to the evolutionary problem, and his subject matter "slips from politics to puns, from Mahomet to Moses," like Praed's vicar.

The book may be read with interest in spite of its occasionally cumbrous phraseology, which, for instance, does not shrink from describing Christ and His followers as having "reached the highest stage of proenvironal aspiration in the religion of Patritheism" (p. 749). M. J.

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THE MONIST

THE ETHICAL SIGNIFICANCE OF TIME.

BENSON, in his *Life* of Edward Fitzgerald, says of the author of Omar Khayyam: "He was often face to face with the mystery that there is really no such thing as the present; the future beckons at first far off, then near; then even in the swift passage of thought, when a man says of a sweet moment, 'It is here,' it is numbered with the past."

There is no word which makes a greater impression upon our imagination than the word time. Voltaire propounded in riddle form some of its mysteries.

"What is it which is at once the longest and the shortest thing in the world? the swiftest and the slowest? most divisible and most extensive? most neglected and most regretted? without which nothing can be done? which consumes everything that is small and gives life to everything that is great?

"It is time. Nothing is longer, since it is the measure of eternity; nothing is briefer, since time is necessary for all we think; nothing is slower for him who waits; nothing quicker in pleasure. Time extends to the infinitely great; it comprehends the infinitely small; all men neglect it, and all men regret the loss of it; nothing happens without it; it covers with oblivion that which is unworthy of posterity, and immortalizes the great things of life."

There is no other idea which holds a greater place in our thoughts, for there is no order of facts in which time is not a factor. Ought we not, therefore, to regard time as one of the great forces of nature—the greatest, perhaps,

since nothing is made without it and nothing can withstand it? Time is the indispensable condition of all evolution, of all development, of all progress. Everything which we see is the work of time, and of all the things that are there is not one which time does not sooner or later destroy—in the social order as well as in the material world.

The slow hand of time levels the mountains and fills up the seas. What is a year, a decade, a millennium to the earth, which takes a million years to lay down a bed of chalk? Sir Walter Raleigh's famous apostrophe to Death were as true an apostrophe to time: "O eloquent and just and mightie Time! whom none can advise, thou hast persuaded; what none hath dared, thou hast done; and whom all the world flattered, thou only hast cast out of the world and despised. Thou hast drawn together all the far-stretched greatness, all the pride, cruelty and ambition of man, and covered it all over with this narrow word—*Finis*."

Fifty years ago man's past was supposed to include less than six thousand years. To-day the beginning of the race are traced back for hundreds of thousands of years. The so-called ancient history of Egypt and Mesopotamia is modern compared with the earliest chapters of mankind's history. And yet, although we know that early man was a contemporary of the mammoth and "a function of the ice-age," as the late Henry Adams has put it, nevertheless, enormously long as the stem of the race may seem, compared with the first appearance of organic life upon the earth, man is among the youngest of terrestrial phenomena. For if organic terrestrial life were but twenty-four hours old, the human race would have appeared only within the last six seconds.

The idea of time has ever appealed to philosophers and poets of all ages and all tongues. From remote antiquity poets have personified and apostrophized time. Religions have adored it as a potent divinity. Time is the condition

of production of all phenomena without exception, even of thought. It is the coefficient of everything that is. Renan said: "Time seems to me more and more to be the universal factor, the eternal coefficient of creation." To say that a thing becomes, is to say that it is within a certain time.

Each fact that is produced at a given time is closely linked with all other simultaneous or previous facts. It is the issue of all the past and it conditions all the future. Nothing can happen save upon condition of not only being accompanied, but being preceded and prepared by a more or less long succession of other phenomena. Time is necessary for the accomplishment of mechanical actions; for chemical combinations; for the temperature to rise or fall. The fruits of the earth require time to ripen. Young animals require time to grow. Even thought, the most instantaneous thing of which we can think, takes time to mature. The law of time rules all the events of our life, physical, intellectual, moral; and in the degree in which we have direct and immediate knowledge of facts we establish relations of contemporaneity, of priority, of posteriority which unite them. Perception of relations is the origin of our idea of time.

The physical sciences have to deal with the influence of both space and time upon phenomena. For movement, change, is a relation of them together in the material world. The moral sciences, on the other hand, have only to deal with the factor of time. The facts of knowledge have between them relations of time, but not of extent. They appear in a settled order, but there is no motion attached to their change or alternation. Time is the factor in each and all of them. Time conditions them, not space. Every given fact of knowledge lies between certain anterior facts of knowledge and certain posterior facts of knowledge—between a "fore-knowledge" and an "after-knowledge," and between these two there is no interval, no void.

Every moral fact is born out of a temporal environment, so to speak. Every material fact is born in a spatial environment. When we think of it, time has a certain inalienable majesty pertaining to it. Is not my past knowledge still present with me? and is not my past knowledge as much a part of myself as my present knowledge? The future is an hypothesis, and all the past before the beginning of my knowledge is an hypothesis. Yet, even though the "before me" and the "after me" are inferences, between them is the present time in which I am I.

Time is an inseparable concomitant of all our perceptions. All perception represents a certain quality and a certain degree of intensity. Perception is due to the distinction which we make between phenomena. Every act of knowledge implies differentiation, i. e., comparison. We are not conscious of the pressure of the atmosphere, or of the rotation of the earth, for the reason that their action is constant. Our senses are unable to perceive any differences or variations. It has been ingeniously demonstrated that if, for some reason, the resistance of the ether were changed, or the rise and fall of the tides altered, or the rotation of the earth accelerated or retarded, all our conclusions with reference to time would be upset. Only a great poet, by that sixth sense of divination which is the gift of the gods to poets, can apprehend what we dull clods are not able to divine, as when Moody writes:

> "This earth is not the steadfast place
> We landsmen build upon;
> From deep to deep she varies pace,
> And while she comes is gone."

Perception is establishing degrees of difference—*nil sentitur nisi quantum*—and terms of comparison are always directly or indirectly borrowed from our past experience. Therefore time is the real coefficient. Things

are large or small, heavy or light, cold or hot. We never have a single perception; everything is relative.

This relativity is no less evident in our moral life. In our feelings there are both quantitative and qualitative differences of intensity, and one of the chief conditions in these differences, as Aristotle long ago pointed out, is *duration*. Pleasure and pain affect us wholly differently, according as they last for but a moment or endure. The prolongation or the repetition of pleasure increases the charm of it; but too much of even a good thing brings satiety and indifference, even repugnance. The key to the sentiment is time.

On the other hand, time moderates grief and softens disappointment. Griefs which we revisit in memory do not increase our original sense of pain or loss. All of us are more or less incapable of sustaining a continuous tension. Things of every kind impinge upon our minds, and in proportion as our attention is diverted the tension relaxes. Pascal has described in unforgettable language the power of occupation to assuage grief. Charles Lamb showed it by example.

We often hear the saying: "Times have changed." But the different sectors of time are absolutely identical. Time changes nothing, but things change with time. For nothing in nature is immutable, neither feelings nor material things, neither emotions nor realities. The great verity at the bottom of Buddhism is the impermanence of everything. "All things flow," said Heraclitus; "a man does not bathe twice in the same river."

The truth is that the innumerable facts which succeed one another with bewildering diversity arouse new impressions in us, and under their influence and during their duration *we* change, not time. We are never the same. Sometimes we change or are changed greatly and suddenly; more often we change slowly and gradually, so im-

perceptibly that it requires a crisis or a lapse of years for us to perceive the difference.

Time possesses no quality in itself. It does not vary in pace or intensity. It cannot of itself cause either pleasure or pain. Does time really then exist? Has it a separate, distinct quality independently of what we make of it? All bodies revolve in space, all phenomena are produced in time. Time and space are the first verities. They are called self-evident. But are they? Time is not an entity, nor even a quality. It is neither long nor short; slow nor fast, except as we make it so. Is time not then a formal element of knowledge?—i. e., not an objective reality, but only the subjective way in which we recognize realities which in themselves are non-temporal?

Morally speaking, time maintains an absolute neutrality toward us. It has no value except as we employ it. It is indifferent to good or evil. Yet it is a supreme factor in our lives. We are born at a certain time. Our life is made up of a series of longer or shorter events which necessarily terminate at last, i. e., in time. It is impossible to modify the course of time, to arrest it, to hasten it, to retard it, to return upon our path and recover time which has been lost.

"What's time?" Browning makes one of the characters in *A Grammarian's Funeral* exclaim. "Leave 'Now' for dogs and apes. Man has forever." But has he? What is immortality? Is there immortality? "Time will tell," the old saying goes. Will time tell us the answer to this question? How can the answer be proved until time shall be no more? How can immortality be proved until the end of time is reached? And when time shall be no more, will there not be an end to immortality, too?

What do we mean by losing time. To a wise man waste of time is not merely an irritation; it may have almost the proportions of a tragedy. Matthew Arnold,

poet, critic and philosopher that he was, wrote out of the depths of experience when he penned these words: "Give any man all the time that he now wastes, not only on his vices (when he has them), but on useless business, wearisome or deteriorating amusements, trivial letter-writing, random reading, and he will have plenty of time for culture. *Die Zeit ist unendlich lang,* says Goethe; and so it really is. Some of us waste all of it, most of us waste much of it, but all of us waste some."

Economics teaches us that labor is not the only essential to success. One must work at the right time. The operations of agriculture illustrate this. Homer describes the Greek chieftains as grown wise through time. Even so. The wise man takes the counsel of the years against the moment, and the wisdom of the centuries against the years.

What we call "progress" is really intelligent valuation of time, not only the present and the future, but the past also. For the nation which despises tradition, which rejects the cumulated heritage of the race is going backward. Ruskin has put this thought in very beautiful form: "You allow it is wrong to waste time," he argues, "that is, your own time; but then it must be still more wrong to waste other people's time, for you have some right to your own time, but none to theirs. Well then, if it is wrong to waste the time of the living, it must be still more wrong to waste the time of the dead; for the living can redeem their time, the dead cannot. But you waste the best of the time of the dead when you destroy the works they have left you, for to those works they gave the best of their time. . . . God has lent us the earth for our life; it is a great entail. It belongs as much to those who are to come after us. . . . as to us, and we have no right by anything that we do or neglect, to involve them in unnecessary penalties or deprive them of benefits which it was in our power to bequeath."

Time has no material guise. It cannot be perceived.

It has not the quality of objects. Scientifically it is a quantity, a duration. In other words, time is not absolute. The idea is wholly relative. To say that time is either long or short means nothing, for it depends upon comparison, upon the criterion of measurement. What is a day? Is it 24×60 minutes? Is it $\frac{1}{365}$ of a year? The same interval of time may seem long to one person and short to another because the standard of measurement is a personal equation and varies according to the feelings or the interest of each individual.

When we speak of "an interval of time," what do we mean? Mathematicians have shown that we have no direct intuition of the equality of two intervals of time. We cannot perceive the difference, and have to depend upon instruments of precision to inform us. When we compare some events of our life with other events, each has a different quality. There are a certain number which, for one reason or another, have a preponderant importance. These serve as terms of comparison. They are the mile-posts along the road we are traveling; but unlike highway markings, they are not all equally far apart.

Philosophers and scientists have demonstrated with great power and imagination that for beings whose life is much longer or much shorter than ours, time moves at a very different pace. Dwellers on Saturn and the Martians —if there be any—must have appreciations of time very different from ours.

William James pointed out that if we were creatures capable of noting distinctly ten thousand events in a second, instead of ten, and if our life was made up of the same number of impressions, it would be a thousand times briefer. We would live less than a month and personally know nothing of the change of the seasons. If we were born in winter, we should think of summer as we now think of the terrible heat of the carboniferous age. The

operations of nature would be so slow to our senses that they would be inferred, not perceived. The sun would hang stationary in the sky. The moon would seem almost changeless. On the other hand, if we assume the hypothesis of a creature able to experience only a thousandth part of the sensations which we have within a given time, summers and winters to such a person would be like quarters of an hour. The grass and the flowers would grow so quickly that they would seem instantaneous creations. The movements of animals would be as invisible to him as the flight of a cannon-ball is to us. The sun would traverse the sky like a meteor, leaving behind a diaphanous trail of fire.

Janet has very ingeniously shown that we have very unequal estimations of the same period of time, according as to whether it is in the past or in the future, according to whether we are young or old. When we mentally review the happy and the unhappy episodes of our life, the events in which we have been actors, or which we have witnessed, the years are far from having an equal value in our eyes. The phrases "lately" and "long ago," which have a profound significance from the subjective point of view, have no objective sense. Sometimes we apply the former word to remote events, the latter to events which really are not far removed.

Our observation of the heavens is not easy in all climates nor at all times; nor can we measure short intervals of time from watching the sky. Accordingly instruments have been invented like hour-glasses, water-clocks, balance and spring clocks, to produce regular movements which indicate exactly short divisions of time. The stop-watch will measure a fraction of a second. But let us not be deceived. The indications afforded by these instruments are nothing but signs; they have no significance or value except as these indicia awaken a thought or emotion within

On the other hand, Orphism was "dominated by the concepts of time and number, the measure of time," and so developed the idea of justice and righteousness, and at last culminated in a great religion.

Pythagoreanism was deeply imbued with this perception of number as the measure of time; numbers signified the flow of time, and their relations symbolized birth, growth, change, progress, both in the natural and the spiritual world.

The greatest of the Greek thinkers rebelled against mechanistic and quantitative interpretations both of cosmology and religion. For Anaximander and Heraclitus qualitative differences were ultimate values. "All who are born," said Anaximander, "must pay the penalty of injustice by perishing according to the order of time." For Heraclitus time and flow were everything. In Pindar, Zeus is addressed as the son of Kronos and Rhea, i. e., of Time and Flow. Aphrodite was originally the Queen of Life. The fall of man, the breaking-up of the Golden Age of the gnomic poets, was the end of the reign of Aphrodite. In this myth the relation of life to time and the moral factor inherent in the idea of time are manifest. The degeneration of Aphrodite worship was the prostitution of the functional production of life to sensual gratification, by which the original beauty of the cult was destroyed.

If the ancient Greeks had continued to adhere to a purely spatial interpretation of life, they would never have created a moral philosophy, nor a spiritual religion, nor an organic society. The Greek states would have been mere physical agglomerations of men instead of social organisms. The conceptions of justice, religion and society were born of the Greek understanding of the nature of time. Hence Hesiod's *Works and Days* is both an agricultural treatise and a manual of ethics.

"This primitive correspondence between the ordered

process of the year bringing fruit," says Mr. Cornford, "and the 'appointed path' of 'seasonable works' which those fruits reward, helps to explain why the wheel of time is also the wheel of right." In Sophocles' *Ajax* the relation between lapse of time and inevitable justice is several times exquisitely expressed:

"Time in the length of his unnumbered years gives birth to all things out of the darkness, and when they come into the light hides them again. And so, too, there is a turn of the wheel that abases pride."

Ajax is made to say: "Even things dread and powerful yield to dignities. The snowy winter gives place to fruitful summer. Night's weary round makes room for day, with her white steeds. . . . And shall I also not learn to curb my pride?"

From the seasonal round of summer and winter it is an easy transition to worship of the heavenly bodies. Sophocles compares the turning of the wheel of human destiny to the waxing and the waning of the moon. "Sorrow and joy come round to all as the Bear moves in his circling path."

Nietzsche, in his *Birth of Tragedy*, has magnificently said that "a people (and for the rest also a man) is worth just as much only as its ability to impress on its existence the seal of eternity." This is what the Greeks did, and they did it through their perception of the moral attributes of time. To those having eyes to see and hearts to understand, the myths of Aphrodite and of Kronos and Rhea were intimations of God. But they taught by mystery and allegory, not by dogmatic and theological exposition. Just here was the ground of feud between Julian and the Church of the fourth century. The myths told Julian that the gods are, which is what the Christians denied. The dying paganism of the fourth century believed that "Greek philosophy was the relic of a primeval revelation."

Greek philosophy recognized the inevitable justice of time. But it tempered that justice with mercy. Hence the Great Year. "The cycle, instead of going on forever, is terminated by the limit of the Great Year of ten thousand solar years; at the end of this period the soul may escape and fly aloft to the fiery heavens whence it came, regaining perfection and divinity. The new Great Year begins (for the cycle of time is endless), and a new world is born, to pass away in its season and give place to another."

It required the genius of Christian theology to devise eternal damnation, even for babes. Greek immortality (and the greatest of the Greeks did not so believe[1]) was life eternal, because it was never-ending functioning of the spirit through all time. But early Christianity's doctrine of the resurrection of the body, in the minds of too many, carried with it the idea of a physical heaven of endless material pleasures, not of spiritual growth. Along with this went a teaching of retribution and justice so crass and unethical as to make literal Christianity of the post-apostolic period a terrible disillusionment.

It is a sad commentary on the "progress" of humanity that modern Christianity has not yet wholly emancipated itself from the thraldom of this base teaching. Emerson was shocked into the writing of his essay on *Compensation* by hearing a sermon in a New England pulpit actually of a piece with this philosophy. In the opening paragraphs he tells the tale.

With the triumph of Christianity and the dogma of immortality a question was raised in the minds of men which pagan thought, so far as I know, busied itself but little with. Where was the soul, the I, the Me, before birth? Was it in time? or from eternity? and whence came

[1] The Stoic and Epicurean ruggedly resisted the belief in immortality as against reason and nature. Who does not know that magnificent passage in *Phaedo*?

it? St. Augustine asked these questions in almost piercing accents.

"Those earliest years whereof I have no remembrance, which I take on others' words, and guess from other infants that I have passed, true though the guess be, I am loath to count in this life of mine which I live in this world. For no less than that which I spent in my mother's womb is it hid from me in the shadows of forgetfulness. What have I to do with that of which I can recall no vestige?.... Tell me, O God, did my infancy succeed another age of mine that died before it? Was it that which I spent in my mother's womb? For of that I have heard somewhat, and have myself seen women with child? And what, before that life, again? Was I anywhere? or anybody? For this I have none to tell me, neither father nor mother, nor experience of others, nor mine own memory."

The tragic questions to which the idea of time gives rise are only equaled by the tragic conditions which the passage of time imposes. It is a common saying that time will determine the measure of a man. But does it? Did not Sir Thomas Browne write more truly when, in that matchless essay on *Urn-Burial*, he said: "The iniquity of oblivion scattereth her poppy, and deals with the memory of man without distinction to merit of perpetuity....Time hath spared the epitaph of Adrian's horse, confounded that of himself....Who knows whether the best of men be known, or whether there be not more remarkable persons forgot than any that be remembered in the known account of time?"

Do the truly great get their reward in time? If time were juster, would not many now forgotten be known? *Ibant obscuri*!

There is nothing new in Nietzsche's doctrine of "eternal recurrence." It is as old as the Greeks and was a striking teaching of Siger of Brabant and the school of

Averroistic Aristotelians in the University of Paris in the thirteenth century. Siger had a vision of time not unlike the Great Year of the Platonists. He believed in cyclic evolution—that the ideas of an epoch or of a race, the laws, the civilization, the religion, would return to the point of departure. But as the series of variations and mutations which formed a cycle were almost infinitely long, men were unable to perceive the transitions or even to retain the memory of the changes. Nevertheless, these great eons succeeded one another, the long series of evolutions and transitions ultimately getting around in a circle to the beginning once more.

Mr. William Mackintire Salter is to be given the credit of explaining Nietzsche's "eternal recurrence" to the lay mind as no other commentator upon his philosophy has done. "If I read his mind and soul aright," he has written, "Nietzsche would rather have progress *ad infinitum*. But he takes the world's forces, and the sum of them after current scientific fashion, as measurable, finite. Hence when a certain point in their development and elaboration is reached, there *can* be no further progress, and in a world of movement and change, disintegration and recession become inevitable, with, in the course of infinite time, a repetition of the original developmental process. It was not wish, but intellectual necessity that compelled 'eternal recurrence' with Nietzsche."

Philosophers, scientists, even mathematicians, all are made poets when contemplating time. The brilliant mathematician Sir William Rowan Hamilton somewhere says: "To my particular constitution of mind a mathematic theory presents even more of the intense unity of 'the energy of a living spirit' than the work of a poet or an artist." And he proved the truth of the utterance by a notable demonstration that while geometry, considered as a science,

is founded upon the pure intuition of space, so algebra as a science is based on the pure intuition of time.

The idea of time unceasingly teased the minds of medieval schoolmen because eternality is an attribute of God. One of the most remarkable doctrines of St. Thomas Aquinas is the profound idea that, for God, time or succession, whether in the past or in the future, does not exist. If God remembered the past and was ignorant of futurity, his reason would be like that of man himself, and his knowledge would increase according to the development of his own creation. This would be an imperfection in the Deity. God would be finite, not infinite; mortal, not immortal and eternal. For God the past, the present and the future are an immobile, immutable present, an eternal vision.

The contrast between this stupendous conception of time by the mind of the greatest of medieval philosophers, and the naive mind of the medieval peasant is very striking. It is an important truth for the historical student to perceive that men belonging to wholly different orders and periods live side by side. The mind of the common man is necessarily compelled to concrete expression. Medieval law and custom abound with examples and illustrations of concrete, yet picturesque, concepts of time by the folk mind. A recent commentator on medieval jurisprudence has written: "It is often declared that. . . . a law shall endure so long as the wind blows from the clouds and the world stands; so long as the Main flows into the Rhine. If the shortness of a period of time is to be indicated, it is provided that a piece of land may be acquired during the sleep of the king; during the midday nap of the emperor; or so much land shall be acquired as can be ridden round in a certain time on a horse, or ass, or turned over with the plough, or covered with hides."

The only honest form of cheating is to cheat time—if you can! The inexorability of time and man's inability to

restore the past or to anticipate and govern the future was one of the strongest motives for popular belief in magic in antiquity and in the Middle Ages. Medieval folk-lore is saturated with this inheritance from antiquity. Some of the most beautiful of these tales have to do with the elusive property of time, and above all, with the way in which time may be cheated.

The story of the Garden of Eden became the source of a multitude of legends. The silence of Scripture as to the duration of the sojourn of Adam and Eve in Paradise led to all sorts of conjectures and suppositions. According to St. John Chrysostom they dwelt less than a day there, so great was their haste to disobey. Other theologians were not so pessimistic of original man's disposition to sin, and held that years elapsed before the fall. According to Mohammed (who had ninety thousand conversations with God while he was washing his hands), Adam and Eve lived for five hundred years in the Garden. But whatever the term of years, the figures have no significance, for since they were immortal before tasting the forbidden fruit, time had no meaning for them. They knew neither youth nor age.

One of the most beautiful and popular of these folk legends in the Middle Ages was the story of the Seven Sleepers of Ephesus. How old it is we do not know. But it first appeared in the West in the pages of Gregory of Tours, about 600 A. D. The tale relates that the emperor Decius, famed in Church history as the author of the first great persecution in 250, having decreed that all residents of Ephesus must offer sacrifice to the gods, seven brothers of the city, after distributing their patrimony among the poor, took refuge in a cave in Mount Celion in order to escape the edict.

Every day one of the brothers named Malchus descended the mountain and went into the town to buy bread. One

evening, while comforting each other with prayers, they all fell asleep. According to tradition their slumber lasted for three hundred and seventy-two years. While they slept, days, seasons, men, events moved on. Paganism disappeared and the world became Christian.

At last the brothers awoke, nor knew that they had slept so long, nor anything of the historical changes which had taken place. Malchus went into the city as usual to get bread. He was astonished to see the Cross on the gates of Ephesus instead of the imperial arms, and figures of Christ and the saints in the market-square. The temples were gone. On every side were Christian churches. He walked as a man in a dream. When he entered a bakeshop the baker refused the money which he proffered, marked with the image and superscription of the emperor; he believed that Malchus had discovered an old hidden treasure. In bewilderment Malchus asked for the members of his family. All remembrance of them had vanished. He asked to be taken to the emperor Decius. The people thought him mad.

Finally the whole city, the bishop St. Martin, the local magistrates and a crowd of curious people flocked to the cave in Mount Celion, where the six brothers were patiently awaiting his return. To the astonishment of all, their faces were rosy and full of health—*facies eorum tanquam rosas florentes.* The emperor Theodosius II was informed of the news and hastily came from Constantinople with a great retinue and a company of theologians. When he entered into the grotto there was no need of torches, for the countenances of the young men were like the sun for light. While the emperor embraced their feet, amid the prayers and tears of the multitude, the seven brothers quietly fell asleep again. But this time slumber stole away their spirits to heaven. They were dead.

We find the same tender indulgence of human imagina-

tion in order to defeat time in another form. In this instance the means of evasion is not dream but ecstasy. It is the story of the German Cistercian monk Felix. One day, it is related, he wandered forth from the monastery at sunrise into the woods. He was plunged in deep and pious meditation. A bird, "whiter than snow," was singing in the branches of a tree. Its song was so enchanting that Felix stopped to listen. One feels, in reading this tale, something of that sweet poignancy which Keats expressed in the "Ode to a Nightingale."

As the bird vanished, Felix heard the angelus sounding and hastened to return to the monastery. The porter did not know him. Felix told the story of the bird which he had heard. The porter rubbed his nose and looked askance at the monk. The abbot was summoned; with him came all the brothers of the cloister. Felix again told his story. They laughed derisively, and took him for a lunatic or a vagabond. Finally a very old monk, more than a century old, remembered that when he was a young novice he had heard the tale of how one of the monks years before had wandered off into the forest and never been heard of again.

The registers of the abbey were examined and at last the date of Felix's disappearance was found. More than a hundred years had elapsed between the dawn and the angelus, while he raptly had been listening to the song of the bird. That same evening Felix died with the light of a great peace upon his face. Supreme illusion! "Understanding is always the dupe of the heart," wrote La Rochefoucauld. Do we know truth as much by the heart as by reason?

An Italian *novellino* relates the story of three magicians who visited the court of Frederick II, that marvelous ruler in the thirteenth century whom men called the *stupor mundi,* the wonder of the world. In the emperor's presence they precipitated a violent thunderstorm, accompanied

by lightning and hail. Having received a reward for his feat they asked that they might have a military escort to protect them along the road. Frederick appointed a young knight named Boniface to be their guard. In a trice the wizards translated him to the heart of Asia, across seas and desert wastes and high mountains, and set him down in the center of a great empire. Here he won great fame as a knight in brilliant tournaments and as a warrior in battle, conquered many provinces and peoples, founded a kingdom, married a beautiful princess and raised up a family of sons who were almost as doughty soldiers as their father.

At last in his old age Boniface wished to return to the West to see the emperor, who, he reflected, must be somewhat changed by now, grayer but still with firm and elastic step, even after forty years. He arrived in Italy after long and wearisome travel—and found the emperor in the act of washing his hands for dinner. Count Boniface had lived a half century of war and politics before sundown of that day.

The story is the reverse of the tale of the Seven Sleepers, and of the monk Felix. Instead of a few hours having been stretched out into centuries, though the period seemed a mere moment, in this last tale fifty years of Cathay were compressed into the running of an hour-glass.

Such legends are not merely credulous beliefs of an ignorant and superstitious people, nor yet solely poetic fancies of the Middle Ages. They have their origin in human psychology. There is comfort found in illusion. What the world calls reality, to some seems utter unreality. The materials of life are common to all of us. But the kind of architecture is our own. Is a castle in Spain less real than an actual edifice of stone and mortar? To some of us Bohemia has a coast. To some objectively means incompletely; fulness is only found in the subjective. Time,

cepts have more than one origin; but it doubtless had some share in that dominance. Rhythms tempt imagination to create for itself an ecstasy out of one stupendous cosmic cycle. A day in Brahma's life, ran the Hindu legend, lasted for 4,320,000 years; his year had 360 such days and his life was 100 years; then he began a new life.[2] Imagination thus gratifies its delight in immensity and balks the puzzle of eternity by making every ending another beginning.

When Thales started Western thought on its long march with a primary conception of one universal substance constantly evolving into all the varied items of the world and being constantly restored from them again, his notion of a recurrent cycle of change continued perpetually to fascinate many minds. Nietzsche, more than 2000 years after, sought an eternity for everything—"the sea will wash it up again." Eternal recurrence, he adds, reconciles the materialistic and Platonic extremes of thought. In an infinite universe, he argued, all combinations are realized an infinite number of times, and between any repetition and its recurrence all other possible combinations recur, because each combination determines the series in the same order. Therefore the universe is in constant circular movement.[3] Modern cosmogenic speculation, after opposing the old Greek notion that the cosmic process is a succession of repetitive rounds, tends to return to it. In the days of Clerk Maxwell the destiny of the universe appeared to be an absolute uniformity of temperature: then the birth of worlds would end and cosmic evolution conclude in all its forms. Many now suspect a constant birth of new worlds, which may continually originate life and evolve it. This view tends to receive the old Greek belief into favor, though it may not reconstruct it with so rigorous a metaphysic as Nietzsche.

Thought has constantly oscillated, in its vision of vast

[2] Maeterlinck's *Mountain Paths*, p. 209. [3] *The Will to Power*, Bk. 4, 3.

universal change, between this infinity of repetitive cosmic rounds and an infinitely advancing series. The same alternatives of circle or trajectory press for favor in other places. Louis Dollo prefers the trajectory or serial conception of life. His principle of the irreversibility of evolution affirms that an organism can never recover a previous state completely, even if it enters once again under conditions identical with those of its past life. This principle applies primarily to the race, though it may apply also to individuals. Birds, for example, cannot recover the teeth which they lost during the Cretaceous Period. A reptile who deserted the earth for the air was probably the ancestor of the birds. By fitting themselves for flight, with all its consequences, the birds were compelled to alter their reptile heritage—acquiring new characters and losing old ones. Among the losses were teeth. One ancient bird, the Odontopteryx, tried to regain them; but, instead of true teeth, which had been irrevocably lost, it could only acquire saw-like points on the sides of its beak and lower jaw. Dollo attempts to rest the principle of the irreversibility of evolution securely on induction by enumerating other failures analogous to the vain effort of Odontopteryx. He also attempts to establish it deductively. A change is produced by definite causes; only precisely inverse causes can reverse the change: unless the causes which lost birds their teeth are inverted, the lost teeth cannot be recovered. Such inversions are so improbable that reversions will not occur and life is essentially irreversible.[4]

The pineal gland seems to have left its past irrevocably behind it. The pineal gland is "a small somewhat conical body, of unknown function, situated behind the third ventricle of the brain, and containing sand-like particles."[5] Descartes suggested that it was the seat of the soul. Mod-

[4] Branislav Petronievics, "Sur la loi de l'évolution irréversible," *Science Progress*, Jan., 1919.

[5] Murray's *Dictionary*.

ern guesses at its "unknown function" centered steadily on the surmise that it was either a vestige of a central eye or a futile attempt to develop one. Paleontology has apparently confirmed the vestigial eye theory. The ancient amphibian Sphenodon had a third eye in his middle forehead and some of the great winged lizards had also a central eye. The pineal gland appears to be the dwindled remnant of nature's abortive cyclopean experiment. It has, however, not remained functionless: it has substituted one duty for another. "We have hitherto regarded the pineal gland," said Professor Keith recently, "little bigger than a wheat-grain and buried deeply in the brain, as a mere useless vestige of a median or parietal eye, derived from some distant human ancestor in whom that eye was functional, but on the clinical and experimental evidence now rapidly accumulating we must assign to it a place in the machinery which controls the growth of the body."[6] It acts, apparently, by secreting "morphogenetic hormones" and letting them loose into the circulatory system. These minute circulating substances extend pineal influence to the whole body by stimulating or directing the growth of its various organs. It is incredible, or almost incredible, that the pineal gland should ever travel backward along its original route and restore the third eye of Sphenodon to his descendants. We can be reasonably assured that we shall never suffer the inconvenient and unesthetic possession of an eye in the middle of our foreheads. Dollo's principle of the irreversibility of life seems, here at any rate, to be both certain and welcome. Euclid was fond of insisting that what applied to a particular triangle applied also to other triangles; similarly, we may suppose, that as birds cannot recover their ancestral teeth or we our ancestral central eye, so life in all its physical aspects is es-

[6] *British Association Addresses*, 1919: Address to the Anthropological Section.

sentially irreversible. It seems improbable that life on earth will ever return to the protoplasm from which it probably sprang. If there is a great cosmic cycle it probably does not include within it a minor cycle of life which constantly returns all living things to the primal germinal material from which they first came.

It would still be possible, of course, for successive developments to repeat the history of terrestrial life. If a large, swiftly moving body crashed into the sun a wave of heat would travel to the earth, destroy all life upon it and make of it a ball of fire. When it had cooled it might again bring forth life, which might repeat its present course. One description might serve as one history of many manifestations of life: as it has often happened on other planets, as it proceeds on earth, now, and as it is destined often to occur again. Such repetitions would be from fresh originations: they would not be recurrences in a circuit of change. The same irreversible march of life might constantly begin from countless cosmic centers, though each march were in a straight line that never returned upon itself. If life be really irreversible, man, as he now exists, will not revert to the species which lie behind him on his route. In the biological sphere, in the physiological domain, irreversibility seems to be the law.

Cyclic recurrence, as such, is not logically excluded by irreversibility. The circuit of development might, abstractly considered, circle from proto-life to man and round from man to proto-life again. Irreversibility, abstractly considered, only excludes an oscillation from proto-life to man and back from him, retracing its path, to proto-life again. The evolution of biological species, however, seems to present neither the possibility nor the appearance of cyclic recurrence. Life seems to grow away continually from its base in proto-life, constantly producing new species that do not repeat the old.

It is less certain that there is no cyclic recurrence in human thought: less certain that throughout thought, as throughout nature, the "primary figure" of the circle is not "repeated without end." It still remains abstractly possible, despite seeming biological irreversibility, that the line from proto-life to man is really an arc, indiscernible as such, of a vast circuit between them. The arc often seems distinctly perceptible, if the circuit itself is not actually completed, in the line of mental movement. "Thoughts and things," wrote James, "are names for two sorts of object, which common sense will always find contrasted and will always practically oppose to each other."[7] Descartes encouraged philosophers to cut this distinction so deeply as to create an apparently insoluble mystery out of the connection between the body, which belongs to the world of things, and the mind, which belongs to the world of thought. There seems to be no possible point of contact between particles with material properties moving in space and the mind which seems to have no spatiality, no weight nor other material property. Greek thought began by making the distinction between thought and thing, between soul and body, without cutting it deeply enough to sever them. Aristotle, reviewing the opinions of his predecessors, remarks that they regarded the soul as "one of the objects which are in motion."[8] Both things and thoughts, soul and body, were composed of corpuscles, of material atoms: they were thus enough alike to be partners. Democritus assigned the more subtle, finer and swifter atoms to the soul to distinguish it from the grosser body and from things. He declared, adds Aristotle, "that those [atoms] which are spherical in shape constitute fire and soul" because "atoms of such configuration are best able to penetrate through everything, and to set other things in mo-

[7] *Essays in Radical Empiricism*, p. 1.

[8] *Psychology*, Ch. 2, Wallace's translation.

tion at the same time as they are moved themselves, the assumption here being that the soul is that which supplies animals with motion."[9] The parallel between soul and fire, which long impressed thought as very rarified matter, brings out very clearly this first effort of thought to connect matter and soul by composing them both of corpuscles and to distinguish them by assigning grosser particles to the one and subtler particles to the other. Some of the Pythagoreans, Aristotle continues, "maintained that the soul was the motes within the air. . . .because they present the appearance of continual movement, even though there be a perfect calm."[10] There were hints even within early Greek thought of the perplexing necessity, afterward firmly insisted upon by Descartes, to sever the nature of soul or mind from the nature of body and things. Anaxagoras, Aristotle notes, "describes mind as the principle of movement," and some Pythagoreans held that the soul put the "motes within the air" in motion.[11] The corpuscular view of the soul was already surrounded by suggestions that mind and soul were non-material and outside the world of atoms; but the opinion that mind is subtly corpuscular was a definite mental species in the beginnings of philosophy. Descartes stamped into thinking the distinction between thing and thought as corpuscular and non-corpuscular; but he, apparently, did not preclude a reversion to the older belief. Henslow, quoting Prof. Edgar Lucien Larkin, Director of the Lowe Conservatory in California, through Mr. W. Britton Harvey, describes a startling reversion to the old opinion of Democritus that matter and mind share in a common corpuscular constitution. "When William Crookes made his first experiments with high vacuum tubes, matter put on an entirely new condition. He called it 'radiant matter.' This was in 1879. The glowing bombarding particles he called 'corpuscles,' others,

[9] *Loc. cit.*, Ch. 2. [10] *Loc. cit.*, Ch. 2. [11] *Loc. cit*, Ch. 3.

'electrons.' But the point is that nothing else, whatever, is in existence. All atoms of matter and of mind are made of corpuscles and these are *made of electricity and nothing else.* Telepathy consists of a flow of corpuscles away from a mental center and impact on another.... *Thoughts are things—currents of real corpuscles*....Our minds, our very thoughts, conscious and subconscious, are flows of corpuscles. *Thoughts are as real as these corpuscles.*"[12] Thought seems to have circled back to Democritus—the belief that both mind and matter are corpuscular, and similarly corpuscular, appears to be a cyclic recurrence.

Participation in a common corpuscularity is one concrete expression of community of nature between thoughts and things. Primitive thought began with a general acceptance of this community, or, at least, with a general disability to escape from it. Australian aborigines still think that they can transfer toothaches to stones and so pass them into other unfortunates who chance to rub against them. The savage cannot realize that dreams are thoughts in his own mind and not "things" that come to him or to which he goes. A similar tendency to treat thoughts as if they were physical objects, like shoes and ships and sealing-wax, again pervades the thinking of the day. This tendency appears to be a return to an older method of thinking after a period of determined effort to place thoughts and things at opposite poles of being. It had seemed obvious that, though trees and stones and beetles were open to inspection by all, thoughts were privately experienced and privately possessed. They could be communicated, as a writer bares his soul; they could be deduced, as a man reads the face of his friend; they could be known through gesture, cry or speech. But the necessity laid upon men to perfect language for expressing their thoughts to one another seemed to be a necessity because these thoughts belonged exclusively to single

[12] *Proofs of the Truths of Spiritualism*, Ch. 13.

minds and did not dwell, like sticks and stones, in the open air. Memories of material scenes and things seemed to differ, in their privacy as mental existents, from the scenes and things of which they were memories. A mountain could be seen and remembered by a countless multitude; each member of the multitude had his own memory, independent of the rest, private and inalienable to himself, appearing before his own mind's eye whether others were experiencing it or not and dying with him without prejudice to the memories of others. Thoughts and physical objects seemed to be things apart, these being private processes in single minds, those being out in the open and accessible to all. To-day thoughts are being swept out of their isolation in single minds to keep company with outer things. It may be true that, as James thought, common sense will always contrast and oppose thoughts and things as if they were different sorts of object; it is also true that there is a tendency, too sharply marked to be mistaken, to treat thoughts as if they were things. In the preface to *The Candle of Vision*, "A. E." speaks of ". . . windows in the soul through which can be seen Images created not by human but by the divine imagination." The "Image," the mental picture, because it seems of all thinking most expressly to simulate the thing pictured (a mental picture in memory of a tree seems to be a copy of the real object in a way in which its verbal description is not), is most readily assimilated to the physical object. When A. E. speaks of images in the divine mind as if they were planets created by his hand and, like them, perceptible, he proposes them as candidates for the world of things—he sets thoughts in the same world as physical objects. He does not merely deviate for a moment from the customary opposition between mental images and material things when speaking of the divine mind. The pots we make or the books we read are *things*, extended in space, alterable in position, changing hands,

equally perceptible to other eyes and our own. He treats our mental images as if they were companions to these pots and books. "I know," he writes, "that my brain is a court where many living creatures throng";[13] "I was certain that the images which populate the brain have not always been there, nor are refashioned from things seen."[14] The image, from being a permanent resident in a single mind and stirred there originally into existence by the action of an external thing, has become a physical thing itself, passing from one mind to another, as a ball may be tossed from one hand to another. "I know that with the pictures of memory mingle pictures which came to us, *sometimes from the minds of others*,. . . . and as meditation grows more exalted, the forms traceable to memory tend to disappear, and we have access to a memory greater than our own, the treasure-house of august memories in the innumerable being of earth."[15] He makes a distinction still between memories in the customary sense, produced in private and experienced in private by a single memorizing mind, and images that lie in earth's treasury, like bullion in a chest, or stored in other minds ready for migration. But a diffusion has begun of memories, of mental images, into the physical world to join the company of things that lie openly without or move from place to place. He speaks of "quickened memories" invading his brain,[16] of the "reperception of an image in memory which is personal to us" as in no way differing "as a psychical act from the perception of images in the memory of earth," of "the ethereal medium which is the keeper of such images," of "pictures of persons or things long past in time" evoked "deliberately out of the memory of nature."[17] The physical thing continues unchanged by our gaze, as it existed

[13] *The Candle of Vision*, "The Many-coloured Land."
[14] *Loc. cit.*, "The Mingling of Natures." [15] *Ibid.*
[16] *Loc. cit.*, "The Mystery of Nature."
[17] *Loc. cit.*, "The Memory of Earth."

independently of it before, and it continues when our gaze is removed; the memory picture comes into being as we experience it, it tends to alter as we regard it, and it passes away with the passing of our attention from it—such, at any rate, has been modern belief. A. E. obviously speaks of some memory-images as if they retained their being, as if they migrated, as if they claimed an attention with which they were not simultaneously born: as if, in short, they were things like pebbles or telephone poles. He does not, perhaps, consistently and explicitly refer thoughts and things to a common realm of existence or to a common nature: he has a habit of thinking about images, or thoughts, as if he did so refer them, rather than an explicit adoption of that habit as a settled principle. "Imagination," he observes, "is not a vision of something which already exists, and which in itself must be unchanged by the act of seeing, but by imagination what exists in latency or essence is out-realized and is given a form in thought, and we can contemplate with full consciousness that which hitherto had been unrevealed, or only intuitionally surmised."[18] He does, however, steadily tend to diffuse out one class of images into the realm of physical things and to regard them as like in nature to those things. "We must infer," he writes, "when the image is clear and precise, an original of which this is a reflection."[19] The relation of physical object and image, Hyacinth's vision of himself in the water, is here applied to relations between an image, conceived as an object, and reflections of itself. "If I am reproached," he writes again, "for the supposition that the soul of earth preserves memory of itself by casting off instant by instant enduring images of its multitudinous life, I am only saying of nature in its fulness what visible nature is doing in its own fashion without cessation." Such enduring images resemble statues which exist at all times

[18] *Loc. cit.*, "Imagination." [19] *Loc. cit.*, "The Memory of Earth."

—whether they are or are not perceived: this curious reversion to the Greek theory of perception, which supposed our mental pictures of objects to be images constantly emitted by them, marks a corresponding reversion to a community of nature between thoughts and things. He distinguishes the "figures of human memory," accepting them "as being in two dimensions," from the "memory of nature" which "we see in undistorted pictures." In joining the company of physical objects these latter images assume their solidity. They also assume the independence of the perceiving mind which distinguishes the external thing: we must observe whether the horse stands or trots or gallops; we can imagine him as we like, even as breathing fire or swifter than the wind. The figures of imagination, A. E. says, obey his suggestions—they "will walk about with authentic motions and undistorted anatomies."[20] Such "authentic motions and undistorted anatomies," if they are supposed to be reconstructions by the mightiest conscious intellect, involve the intellect in incredulities: these "figures of imagination" are partly independent of the mind which receives them, as the flutter of a flag we have exposed to the wind makes our perceptions follow it and does not follow our perception—they imitate the behavior of real objects so exactly that they must be real objects received by the mind, though obedient to the suggestions of their host. A. E. discovers in his own images a conformity to the "intricate changes" of real objects in real life too miraculously faithful to be the result of his own mind. "I imagine a group of white-robed Arabs standing on a sandy hillock, and they seem of such a noble dignity that I desire to paint them....I say to myself, 'I wish they would raise their arms above their heads,' and at the suggestion all the figures raise their hands as if in salutation of the dawn....The invention

[20] *Loc. cit.*, "Have Imaginations Body?"

and actual drawing of the intricate pattern of light and shade involved by the lifting of the hands of my imaginary Arabs would be considerable. My brain does not by any swift action foresee in detail the pictorial consequence involved by the lifting of arms, but yet by a single wish, a simple mental suggestion, the intricate changes are made in the figures of imagination as they would be if real Arabs stood before me and raised their hands at my call." Such autonomous images must originate outside himself, thinks A. E., and exist independently of him; their autonomy resembles the autonomy of physical objects which change according to a law and order that is recognized and not imposed by the mind.

This identification of mental image and physical object is no casual vagary of a mind driven by vivid imaginative pictures into a confusion between them and outside things. A. E. has reacted to the stimulus of prevailing tendencies, though his personal psychical outfit may have made him very ready to respond to it. He has followed in his own mystical way the more sober, not to say prosaic, journey of philosophy. For philosophy, after a long effort to restrain mental images from mingling with outward objects, after attempting to deprive them of all qualities permissive of mimicry of the physical thing, after insisting on radical distinctions between non-mental bodies and themselves, is deliberately returning them to the outer reality from which they had been hustled into confinement within the mind. Utterances within the contemplative precincts of the Aristotelian Society outmatch, indeed, the imaginative fervor of A. E. Images, declared Professor Alexander, are external or physical because they have the characteristics of physical objects. This concisely summarizes A. E.'s deductions from his Arabs among the sand hillocks. The image and the percept are the same object in different forms—once more Professor Alexander clinches the adoption of the

image among physical things. The dream-apparition is physical[21]—again the philosopher is even more emphatic than A. E. who less concisely or unambiguously suggests that "to speak of the moving pictures of the dream as memories or unconscious reconstructions is to speak without subtlety or intellectual comprehension."[22] A stroller in the jungle meets a tiger and runs. In the quiet of his tent he sees, in memory, that tiger again and perhaps hears its jaws snap. He meets the same tiger, according to Professor Alexander, though he meets it differently, and he meets it again if he dreams of it by night. The same doctrine, sometimes with less explicitness and often with more reluctance to admit images and physical things from their separate folds in the mental and non-mental worlds into a share of common quality in a common realm, has spread widely through recent thought.

Images, visual images, pictures presented to the mind in memory, reverie and dream, are most easily placed in the same status as physical objects because, of all mental processes, they apparently most resemble them. James asked, more comprehensively, "Are thought and thing as heterogeneous as is commonly said?" With equal comprehensiveness he insists that they are not. "Their relations to time," he affirms, "are identical....both may be complex or simple. Both are of kinds, can be compared, added and subtracted and arranged in serial order. All sorts of adjectives qualify our thoughts....they are natural and easy, or laborious. They are beautiful, happy, intense, interesting, wise, idiotic, focal, marginal, useful, confused, vague, precise, rational, casual, general, particular, and many things besides. Moreover, the chapters on 'perception' in the psychology books are full of facts that make for the essential homogeneity of thought with

[21] *Proc. Arist. Soc.*, 1909-10, "On Sensations and Images."

[22] *The Candle of Vision*, "The Architecture of Dream."

things."[23] Thought seems to be making a circuit like the sun in his heaven. With a homogeneity of mind and body, of thought and thing, Greek thought began, and to this homogeneity thought seems to have returned.

Yet our mental life impresses us as irreversible. The middle-aged man can no more return to his childhood in mind than he can in body. His eye falls on the old copy of Robinson Crusoe as it lies forgotten on the shelf and he remembers the thrill when he read it as a boy. He takes it down and turns its pages, seeking for the old moment of fresh impression. He cannot recapture it. The old tale touches experiences that were not there to touch in the boy's mind: the old naïveté, the old freshness, the old openness to ideas which were new then and old now, are gone and gone forever. He has gained as well as lost: the tale has still charm, even more charm, but the charm is not the same. He has changed, and changed permanently. In his mental irreversibility he seems to resemble his family descent: his father did not think exactly like his ancestors, he does not think exactly like his father, his son will think differently from him.

Nations seem to resemble families and the whole human race to resemble nations: men seem unable to speak or write or think as they spoke or wrote or thought in the past. How different is the hand-writing in an old commonplace book, picked from its thirty years in the lumber-room, from the hand-writing of to-day! Paleographers tell us that manuscripts are dated by the character of their hand-writing, though the dating may require much study to decipher it. Style, too, dates the writer. Writers date themselves by their language, by their vocabulary, by turn of phrase, by texture of thought, by the centers of their interest, by the events they deem possible or impossible, by the allusions they make, by the illustrations they spon

[23] *Essays in Radical Empiricism*, p. 29.

taneously employ: by the whole nature, character and being of their thought and style. Each age has its own style and its own thought which stamp a date upon its writers. The writers of one epoch differ from one another, as no two peas in a pod are quite alike; but they all cover their writing with the same date, though they write down the same date differently. Any writing separated from us by more than a generation, a page of Scott, a scene from *Hamlet*, a chapter from *Don Quixote* or from Homer or from Herodotus, has "belonging to the past" as definitely stamped upon it as a recollection of childhood. It seems impossible to confuse one epoch with another or to suppose that any future epoch will repeat the features of the past. Homer, Plato, Isaiah, Dante, Cervantes, Shakespeare, Goethe, these names seem to represent periods of human thought that are as different from one another as they seem unlikely to recur: mental species that seem as different as the biological species that line the route of evolution. "Belonging to the past" does not, of course, mean "having no present value" nor even "having a value inferior to the present."

Thought may, however, travel in some closed circuits through successive and differing epochs. As the sun travels through the heavens he drags the earth continually through space. Within this path the earth ever circles round the sun: so may there be cycles of thought within the moving route of thought. But perfect cycles of thought, like perfect cosmic recurrences, logically deduced by Nietzsche or implied in early cosmogonies, are probably as abstract and as unrealized conceptions as the perfect circle defined by Euclid. Biology hints to us how to estimate the real significance of such apparent reversions as the resemblance of some speculations to the theories of Democritus, just as she hinted to us that all life, including the mental life which is its flower, is essentially irreversible. Nature does not make new species in the perfect likeness of old species; but

she does adapt old plans and use them in new contexts. Animal after animal is built on the old four-limb design. There is room for variation: the creature may have four legs, or two legs with two arms, or two legs with two wings, or it may, if it have marine habits, have legs and fins or fins only. Fundamental habits of thought underlie very diverse manifestations, as the four-limb vertebrate design underlies very diverse species of animals. One universal mental habit pervades thought from Democritus and before him, through Descartes and his contemporaries to the philosophy of to-day. The human mind has always formed its concepts on a few primary models of reality. Physical objects, things in space, independent of our thinking, compelling us to conform our thoughts to the order and law of their existence, are, because of the rigorous adjustment to themselves which they exact from us, one of the dominating influences on our lives. We have to think, because our minds are so predominantly adjusted to the external world, in terms of *things*—things existing in spite of us, singly, permanently, in a way that we have to learn and can only imperfectly control. However we endeavor to restrict thoughts to purely mental existence, however we endeavor to deprive them of the properties characteristic of physical objects, we cannot think right away from the habit of thought imposed upon us by the external world. We think of ourselves as spectators of independent things outside us and as co-actors with them on the stage with which they provide us. Our conception of ourselves and our thoughts is habitually formed upon this primary model of reality. The internal, private world of the mind, whatever our insistence on the absoluteness of the distinction between the mental and the non-mental, is an image of the spectator and his outside world, of the organism and its physical environment. We regard our thoughts as objects surrounding our ego because we

regard physical things as objects surrounding our whole persons. As we perceive and deal with our surroundings, so we are compelled to think of our minds or egos as experiencing and dealing with thoughts, ideas or images which form the contents of their inner, mental worlds. We are inveterate mental modelers on the type of reality provided by the spectator and his material world. This habit may be repressed, almost perhaps to apparent nothingness as the four-limb mammalian design shrinks from notice in the whale. But it is always there and from time to time it becomes insistent. The electrons which some now suppose to compose both the mental and non-mental, both the physical and the psychical, are not the spherical atoms of Democritus. Thought has neither returned upon itself nor reversed its course to move backward. The modern neo-realistic equivalence between image and physical object is not a restoration of Greek notions of perception or imagination. There has been a fresh insistence by a permanent habit of thought. The common-sense opposition between thought and thing, affirmed by James, has never transcended the fundamental model of reality provided by the physical object. Thoughts have always been finally conceived after the manner of things, however scrupulously they have been distinguished from them. The electron theory of the soul, the reduction by A. E. and by the neo-realists of mental images to a physical variety of statues, James's drastic homogenization of thoughts and things, all these are extra insistences by a permanent mental habit which continues to impress upon the human mind a permanent bias, of thinking of the mental in terms of the physical. Fate seems to have decreed that, in the last resort, mental images and statues shall inhabit the same world.

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THE LOGIC AND METAPHYSICS OF OCCAM.

THE following paper is concerned with certain aspects of the subject that retain an interest for the present time, especially those that concern the logic of Occam. But the metaphysics of Occam seemed to me too interesting to be neglected. Still, if I deem it advantageous to treat the logical and the metaphysical aspects of Occam's philosophy separately, it will not be possible to do so in rigid and complete separation, because the scholastic philosophy had developed into a logical philosophy, and because in writers of that time metaphysical elements were very far from being extruded from their logical treatments. Thus Occam did not merely develop the existing logic, but combined with it metaphysical theory as to the nature of individuals.

I. OCCAM'S LOGIC.

There is no need for me to give an account of the rise and development of realism, whose ascendancy was coincident with that of the scholastic philosophy. My proper concern is with the reactive and opposing spirit of nominalism, with Occam as its head and acknowledged exponent. The question between these two—nominalism and realism—had been raised by a passage in the translation by Boëthius of Porphyry's introduction to the logical writings of Aristotle, wherein were involved the nature of general terms and their relation to individual objects. The universal was to Occam only a common conception made by

mental abstraction from the individual things—*conceptus mentis* signifying *univoce plura singularia*. Nominalism denied the existence of anything but the concrete. The real value of universals was denied by Occam. When, however, Occam is so often spoken of as representing extreme nominalism, it seems worth while to remember that a large strain of realism yet appears to have remained in him and other nominalists—so much indeed that his has sometimes been called pseudo-nominalism—since the analytical power of language was directed by them toward the interpretation of nature. The nominalism of Occam had real affinities, too, with conceptualism. Indeed, there have been thinkers who classed Occam as a conceptualist. If nominalism, as Anselm thought, took the terms expressive of general notions to be merely *flatus vocis*. Occam was far from holdng that view. To him universals were assuredly not fictional, not mere sounds. Occam's logic, however, was condemned by the University of Paris in 1339; the date of his death is variously estimated as 1347 and 1349. Nominalism had seemed routed by the scholastic ascendency and the triumph of realism already referred to, but this was far from what was really to happen. Duns Scotus, who taught at Cologne in 1308, was to assert the reality of the individual soul, in place of the former insistence on the principle of individuality (*principium individuationis*). The view of Duns Scotus, according to Occam, was that "in the thing that exists outside the soul, the same nature exists *realiter* with the difference limiting it to a determinate individual, being only formally distinguished, and in itself neither universal nor individual, but incompletely universal in the thing, and completely universal in the understanding." And Occam was, in somewhat extreme nominalism, to declare for individuals as the alone real (*sufficiunt singularia et ita tales res universales omnino frustra ponuntur*). In doing so, he was pointing the way to real science

(*scientia est de rebus singularibus*), through immediate apprehension of the actual world. Says Occam, "Nothing which is one in number can, without being charged or multiplied, be present in several subjects or individuals. Science invariably restricts itself to propositions regarding the known; it is, therefore, a matter of no moment whether the terms of the propositions are known things outside the soul, or only in the soul; and therefore it is not necessary for the sake of science to assume universal things, really distinct from individual things."[1] From another side, however, it has been urged that nominalism was skeptical of science; that it emphasized the individual, the particular, whereas science aims at the universal and the necessary. It would thus be a mass of individuals, lacking all law and order, and science would be impossible. It seems to me there are elements of truth, not difficult to reconcile, in both contentions. For with empiric observation of individual things, there must be conjoined the derivation of universal principles from the *inductive and deductive processes of our mental experience*. But nominalism was apt to contradict its own principles.

The revival and spread of nominalism in the fourteenth century was what might have been expected to follow a purely logical philosophy, and the results were big for science, too much neglected since the days of Roger Bacon, and of Albertus Magnus, who deserves far more scientific credit than he almost ever gets.[2] Occam relegated the universal to psychology and logic, and banned it in metaphysics. His main line of argumentation was "that the universal is not something real that has explicit subjectivity —neither in the soul nor in the thing. It is something conceived, which, however, has objective reality in the soul, while the external thing has this objective reality as an ex-

[1] Hegel's *History of Philosophy*, Vol. III, p. 84.

[2] Cf. my article in *Hibbert Journal*, July, 1918.

regulated, since it carries its own logic inherently within itself.

The great work of Occam, *Summa Totius Logicae,* was one of severe precision and strict orderliness; by means of divisions, subdivisions, re-subdivisions, positings, demonstrations and solutions of objections, the work was carried out in massive form, not without affectation of mathematical order. Occam is free of the tendency to digression sometimes characteristic of logicians of that time, not least of his redoubtable opponent Wyclif, who, however, was no whit behind Occam in subtlety and originality. Lotze says of that period that "traditional custom directed attention almost exclusively to the concept, the most unproductive of the forms of thought; diverting it from the consideration of the judgment and the syllogism."[5] This is rather loose and vague, even if correct, i. e., even though we grant the tendency to treat essential concepts too often as distinct entities. It is more exact and helpful to say that Boëthius had proposed to use concepts and maxims for the upbuilding of science, as was practised in mathematics; that Anselm had put forward an *ensemble* of theorems relative to the Divine attributes and their *rapports* with the world; that Scotus Erigena had represented the purely deductive type; that logic had become, in the hands of the Arabian philosophers, the science of argumentation; that to Albertus Magnus, in the thirteenth century, it meant the syllogism, with consideration of induction (*inductio est a singularibus in universalia progressio*); that to Duns Scotus in the fourteenth it was the science of the syllogism; and that the dry syllogistic form of argumentation was no less followed by Occam, with not a little importance, consistently or not, still attaching to abstract notions. These thinkers, to whom the syllogism was a didactic procedure of the first order, would, I fear, scarcely have appreciated

[5] *Mikrokosmos,* Vol. II, p. 338.

the statement that "a trained logician may be a very poor reasoner, and a very good reasoner may know nothing of logical science."[6] That does not keep logic from being an aid to correct thinking, and the improvement of the discriminative powers.

The universal in Occam's *Logic* is sometimes real outside the mind or soul that knows it.[7] The universal is particular in our individual mind, but universal in the sense that it is a sign of things many. Universality, the *Logic* affirms, is nothing but a quality of certain concepts (*quod quodlibet universale est una res singularis et ideo non est universale nisi per significationem, quia est signum plurium*). But Occam was a startling innovator in his theory of knowledge, and his positions, as set forth in the *Logic,* must be taken account of. Occam, whose psychology we must allow to be somewhat involved here, rejected the *species intelligibiles* of Aquinas and Duns Scotus, for to him this would have meant a needless and unjustifiable doubling of the object or the external reality. This latter, as an object of knowledge, would, he thought, be assumed to have another existence—that of being psychically real. The idea or the concept merely forms a *sign* of the thing that corresponds to it. The sign, says Occam in the *Logic,* is that the knowledge of which brings us to the knowledge of another thing (*quod apprehensum aliquid aliud in cognitionem facit venire*). But the sign is not, in Occam's view, a copy of it. For the inner formation or structure is, to him, different in nature from the outer reality—of which it is *sign,* but not copy. The signs are arbitrary symbols, words, says the *Logic.* Things were, to Occam, other than our ideas of them. But the mind cannot think of the individual thing without thinking of a class to which it belongs.

[6] A. Rashdall, *Theory of Good and Evil,* Vol. II, p. 419.

[7] Yet his conceptualist leanings appear in calling the universal an intention of the mind (*intentio animae*) in the *Logic* (I, c. 15).

Occam thus emphasizes the part played by the mind itself in knowledge. The "terminism" of Occam, which was bred of a reaction against the formalism of Duns Scotus, thus laid a certain foundation for an idealism of psychological and epistemological character, whatever we may think of it. Although Duns Scotus had been so largely charged with realistic elements, yet his insistences on individual experience called for a theory of knowledge like that which was advocated by Occam. This, however, has not gone without much criticism from realist philosophers. It is too often forgotten that, in his opposition to the doctrine of "species" as an *intermediary* between the object and the knowing subject, Occam had a precursor in Roger Bacon, who stood for direct knowledge. For him, the universal is a specific essence realized *tota et totaliter* in each of the individuals of a like "species."

It must be remembered, too, that Scotus Erigena, influenced by neo-Platonic realism, had found truth and being in the universal; so that the universal, that is to say, the class-concept or logical genus, had figured as the original and essential reality. By or through the universal, accordingly, the particular was to be understood, and from it was to be derived. *Universale in essendo,* said Avicenna and other Arabian philosophers. Universals thus came to be treated as substances (*res* giving rise to "realism"). The universals were not only held to be substances, but were considered the more real the more universal they were. It was in this realist atmosphere that Anselm fittingly produced his argument for God as the most real, because the most universal, Being. Aquinas, too, held the general or universal Being to be our first datum, yet he did not hold the Platonic independent existence of universals, but, Aristotelianwise, to the necessity of active and abstractive intellect. The first place was assigned by Duns Scotus to the single entity or particular object, from which the uni-

versal is abstracted. But the individual of Duns Scotus was constituted of the principle of the universal (*quidditas*) and the principle of individual difference (*haecceitas*). Their union in the individual made reality for him. Occam's leanings were with the Scotist contention, and he laid his stress on particulars. The universal was, to him, what had to be explained. The precise opposite of this position forms the logical difficulty to-day for some writers, who say the difficulty "that presents itself to logic is not in universals, for *all* logical entities seem to be universals, but in particulars. Can logic define a particular entity?"[8] Not that Occam denied the likenesses to be found in particulars, or that the likenesses are real, though abstracted from the particulars. He thus did not deny any and every sort of objectivity to universals, as we have already seen from the *Logic*. The universal is an intention of the mind (*intentio mentis*), the *Logic* says. Its character is conceptual (as an object), that is to say, not substantial. Occam significantly argues in the *Logic* that no individual could come into existence if the universal were a substance, because the universal in it would already be real in another. Everything that exists is singular and numerically one, he elsewhere affirms. But still, he does not deny some sort of objective existence—defective as it might be—to universals: he thinks we know them by abstraction or conception. But Occam thought that the self entered into the constitution of universals in a way that did not obtain in the case of the particulars. That is, he inclines to undervaluing the conceptual. But the generic notion, say, of "man," has certainly wider reference in reality—in things themselves—than merely as a thought, idea or concept, in the individual mind. The generic concept was therefore taken by realist contention to have warrant in the nature of reality, and to signify a perfect equality of essence, in spite of the

[8] E. B. Holt, *The Concept of Consciousness*, p. 43.

diversities found in particular individuals. Not without that essence could the thing be itself, and different from all else. Not without it can you have a true notion of any concrete thing or being. The essence you do not know *per se,* but as it individuates itself, for knowledge is of individual objects. The essence is the "whatness" of the thing, and is a universal, but it is an entity of the logical type. This does not keep the particularist from sometimes disparaging the universal as abstract, and lacking the rich originality of the particular. This is to overlook the real or factual value attaching to the abstract or universal principles, which are not without real basis in the nature of things. Occam's lack is in defining the universal otherwise than in a merely negative way: the particular he defines more satisfactorily, if only by his insistences on numerical difference.[9] Not that I attach the importance to numerical diversity that Occam did, in defining the particular, and that some have done after him, for here we are but in the region of the existence of the individual, and have not yet penetrated to the nature of the individual object; more than more existence is required for individuation, as Duns Scotus, in fact, clearly saw. He saw that the *haecceitas* involved something of the nature of "positive entity" or "individual nature," which became fused with the common nature. The individual is not something to be settled in terms of sense-presentation. The finite or individual is, no doubt, "for itself." But so long as you keep to a numerical one, you are shutting out relation, and making the one meaningless. The entity of the individual is something essentially intelligible—not material, and not accidental—for there is idea behind it. The *individuum* involves other individuals, yet it negates them all. The logical individual must be essentially unique: the mere empiric individual of

[9] Mr. C. Delisle Burns has a paper on "Ockham and 'Universals'" in *Proc. Arist. Soc.,* 1913-14, emphasizing this point.

sense is not enough. The value, however, of Occam's justice to the particular, such as it was, is not to be denied, for the particular is still sometimes treated as somehow deficient in reality. This is because it has not the definite, changeless character of the universal. In such a system as that of Dr. Bosanquet, for example, the finite or particular is interpreted in terms of the cosmic or universal. Still, the fact is to be recognized that Occam postulates also a certain objective reality for universals, though it might not be of an *in rebus* character. His treatment cannot here be developed in detailed form. If Occam did not succeed in reaching full and perfect treatment of the relations subsisting between universals and particulars, we may recall how difficult and disputed the subject still is, and we shall at least find much in his treatment to appreciate, as well as the fact of his striking insistence on its discussion in his time. Feuerbach once declared the relation of the general to the singular—of the species to the individual—to be the most important and the most difficult question in philosophy. This he held to be evidenced by the fact that the whole history of philosophy—the controversies between Stoics and Epicureans, Platonists and Aristotelians, skeptics and dogmatists, in ancient times; between nominalists and realists, in the Middle Ages; and between idealists and realists in modern times—has turned upon it. I have merely sought to indicate the attitude of Occam to the problem, as part of his general system.

One of the questions of greatest concern to logicians of that time was that of insolubles (*de insolubilibus*). The position of Occam on that subject has been stated as follows in the article "Insolubilia" in Baldwin's *Dictionary of Philosophy*: Occam "admits the validity of the argumentation" (whereby propositions were shown to be both true and not) and of "its consequence, which is that there can be no such proposition, and attempts to show by other

arguments that no proposition can assert anything of itself."[10] The article goes on to say: "Many logical writers follow Occam in the first part of his solution, but fail to see the need of the second part." I am myself much inclined to agree with Occam on both counts. With him on the first, because such proposition is not a true proposition, only a pseudo-proposition; for a proposition must be either true or false, not "true and not." The proposition exists, of course, as a form of words; has being, that is to say—the only truth it has—but is not a proposition, for it has no meaning. With what Mr. Russell has said as to "Being," what I have now said is in accord, for he says that "being is that which belongs to every conceivable term, to every possible object of thought—in short, to everything that can possibly occur in any proposition, true or false, and to all such propositions themselves." The position is not new with Mr. Russell's formulation of it, as I have met with it in able but little-known logicians, many years before. But it makes being, I think, the lowest possible category, lower, if possible, even than Hegel thought. And it does certainly not follow that all the propositions which have in this sense being have any sort of logical value or meaning. I am with Occam on the second issue, because a proposition must have meaning or signification, apart from or independent of the proposition itself. The proposition cannot include itself, it is sometimes urged, in its own meaning, and with this I am inclined to agree. Says Dr. Bosanquet in his *Logic*: "It is essential to the judgment to affirm a reality outside itself." Formal logicians like Drs. Venn and Keynes insist on the necessity of objective order of some sort in logic, while Sigwart thinks the assumption of an objective order does not even call for justification. I cannot follow Fries, who is a psychological logician, in holding that every proposition asserts its own

[10] *Summa Tot. Log.*, III, iii, c. 38 and 45.

truth (the truth of itself), but I agree with him that that is no proposition which asserts its own falsity, and that is precisely what the *Dictionary* article assertion does. For Fries psychological basis was sufficient guaranty, and to him transcendental method in logic was superfluous. But he and other German psychologists have not shown why, if there are no universals, we can still think and mean them.

The question of insolubles is, however, a much larger one than might be thought from the *Dictionary* article They took many forms, often becoming mere dialectical puzzles. One of them, for example, is that given by Occam's great opponent, Wyclif, who devoted much attention to the subject in his highly important treatise, *Tractatus de Logica* (not mentioned in the *Dictionary* article already referred to), edited by M. H. Dziewicki of Cracow. Wyclif supposes a man to have two slaves, A and B. He resolves to free A, if the first man he meets is a slave; to free B, if the first man he meets is a free man. A, happening to meet B, who is a slave, is instantly free; B meeting A as so freed, is also free; the case is logically impossible, argues Wyclif, but is to be legally met by freeing both. Many of the cases in that time easily ran into the absurd and ridiculous, so that the subject came to lose interest. It is not directly referred to in neo-scholastic text-books like those of Liberatore or Tongiorgi, nor in the *Logicae* of Ubaghs. Indeed, the logico-grammatical method of Occam, and the terminists generally, led to results so paradoxical and false as to give rise to natural grounds of complaint against its abuse. The case chosen for illustration in the *Dictionary* article already referred to, "This assertion is not true," is a negative insoluble, and the negative insolubles are particularly difficult. "This assertion is not true," is false, in the sense that it is true, so far only as it has being as a proposition, that is, exists. But if it be

taken as true, then it denies its own meaning. And so the endless round of true and false goes on, the "insoluble" being essentially something in which it is impossible to deny or to affirm. It is, in fact, a pseudo-proposition. The case in question is a proposition only if we hold that every sentence is one; it is merely a pseudo-proposition, if we hold, as I think we must, that a proposition must signify something true or false. But the syllogistic reasonings make this proposition "true and not," so it is not a proposition in the latter, which is the proper, sense. Since it is not a true proposition, what further concern has logic with it? I regard the syllogistic reasonings in the *Dictionary* article as mere interesting word-play, the proposition being no true proposition. They admirably illustrate the non-valuable, unmeaning character of "insolubles," although the article leaves the whole matter in far too indeterminate a condition, as I have shown. You cannot deal with such matters, and make no consideration of the different senses in which the word "true" is employed or understood. Every true proposition has truth for its primary signification, but "true" may be taken in an absolute sense, or it may be limited to mean only "true" as an existing sentence or proposition, or it may mean "true" of what is neither the proposition itself, nor in any way dependent upon it; or it may mean "true" in the sense that the proposition is in agreement with the meaning intended to be put upon it. What I have been saying is something different from the question of so-called degrees of truth, as that problem has been formulated and discussed by writers on symbolic logic.[11] But I think there is little in "insolubles" that is worth the concern of modern logicians, and nothing about them that casts any reflection on the real utility of logic, as a mental discipline.

It may be remarked that Gabriel Biel and John Buridan

[11] See, e. g., A. T. Shearman, *Symbolic Logic*, pp. 25-26.

were, among immediate followers, particularly able expounders of the logical ideas of Occam, and both metaphysical skeptics, but I have no occasion to discuss their work here. It is more important to note how, in subsequent philosophy, the nominalism of Occam reappears, so that, in an important sense, he heralded the dawn of modern philosophy in England, his discriminating mind and powerful personality marking him out from the other leaders of medieval thought. Then, not to speak of the realism of Bacon, there is Hobbes, whose nominalism found vent in the words: "One universal name is imposed on many things for their *similitude in some quality or other accident*, and whereas a proper name bringeth to mind one thing only, universals recall *any one* of those many." Like Hobbes, La Mettrie and Helvetius stoutly denied the existence of universals, for nominalism was largely supported by materialists. I think it worth noting that Bossuet, in contending with Leibniz, took the interesting position that the universal is not—so his attitude has by a French writer been expressed—"that which comprises all, but that which extends everywhere, that which, present everywhere, carries with it the ascendency of strength and unity." Berkeley's notable nominalism thinks "the generality of men" do not pretend to have such "abstract notions." He thinks particular ideas may, from "mutual resemblance," belong to the same kind, without the need of "any abstract general idea." Hume, too, laid great stress on perceived resemblance, and assailed the reality of universals just as the terminism of Occam had done. For Hume a genuine universal did not exist, either *mentaliter* or *realiter*. His influence on Kant is well known. The nominalist position was upheld by Stewart and Hamilton, the former repeating the perceived resemblance tradition with all faithfulness. What they all deny is, that this conception of similarity could really constitute a general notion. In Hegel, there is em-

phasis on the fact that the universal is *actual* only as individual. That is to say, the species exists only in individuals, each of whom represents the whole species. In this way, the individual is the universal. Particularity is thus *determinate* universality. Lotze was a nominalist, denying the objective reality of the *genus* idea, to him universals have no real existence in things themselves. Rosmini, on the other hand, who says he has never had a thought of becoming a nominalist, holds that nominalism is a system which sterilizes humanity. His discussion is very suggestive; he thinks that, in a universal idea, there is the quality thought of, to which there is corresponding reality in external individual things; and the universality of that quality exists for him in the mind only. But enough has now been said of the subject.

II. OCCAM'S METAPHYSICS.

Some of the aspects which we have had to consider under the logical section, those of realism for example, one might have wished to include rather under the present section, as pertaining to ontology. But to-day we relegate them rather to epistemology, and Occam's epistemology we have already considered. What concerns me, however, is Occam's metaphysics proper. The arguments whereby rational theology had been wont to prove the existence of God were rejected by Occam, who left men faith here, not demonstration. In this Occam had the merit to anticipate Kant, but he fell back on bare authority, instead of on the practical reason, as did Kant. Neither the ontological nor the cosmological argument appealed to him. In fact, none of the truths of theology were to him capable of philosophical proof. The existence of a First Cause he regarded as a purely hypothetical necessity. He upheld the argument of Duns Scotus as to the impossibility of an infinite chain of causes, but Occam was distinctive in laying more stress

on the question of conservation than of production. "It would seem," said Occam, "that the priority of the efficient cause can be proved with more evidence with respect to the conservation of a thing by its cause than with respect to its production thereby." In this Occam had the merit to anticipate Descartes in the latter's third "Meditation." Occam said if a cause creates a thing, it can only create it a particular individual. He remained undecided whether, as a somewhat radical nominalist, to deny only the universal —equal constituents or sides of things—or the causal connection, changes of effect, between finite things, also. Yet the Ground of all things, unified, all-embracing, lies in God, whom the causal connection in whole presupposes. But if a rational or scientific theology can be thought to be grounded in Him, Occam for his part denied it any foothold within the circle of experience, and, as transcending such experience as obtains in the case of other individual beings, it is assigned by him to faith. This shattering the bridge between the particulars of sensible experience and God, as ultimate ground of all existence, was a most serious attitude for Occam and the nominalists to assume, for it shut off from view the reasonableness of what was to be believed, and yet thought to sustain the reasonableness of believing. Nominalism made religion something other than knowledge and philosophy, however, and by its emphasis on the significance of the concrete, it laid a new foundation for psychology.

We have thus seen that, in the view of Occam, speculation in general does not engage in the inquiry of God.[12] Occam thought, that is to say, that, apart from direct revelation, to which in fact his positivism led him, it was beyond the province of man to know what God is—His unity, and His infinitude. All this, however, did not mean that Occam, who was critic by nature, was either hostile or indifferent

[12] So his *Centilogium theologicum.*

to the Church, for he was neither. Luther, we know, praised Occam as the most ingenious of the schoolmen, and derived from him his conception of the Eucharist. Only in metaphysics was Occam skeptic; he was much less moralist and rationalist than might appear; in his religious philosophy, he *believed* because he thought we could not know. Occam's position was that science has only to do with phenomena which it observes, and that what lies beyond this is the object of belief alone. Duns Scotus had taken up a like position as to the separation, and even opposition, of faith and knowledge. Dr. Seeberg has termed Occam "a fanatic of logic," in the hairsplitting scholastic connection. But Occam's appeal, for all that, was to experience, and away from the prevailing abstractions of philosophy. And, although we are not concerned with that here, I may remark that it was a thing of great significance for the future that, in fixing the limits of theology as he did, Occam was acting in order to the independence of the sciences, of logic, of the science of language, of jurisprudence and of the State. For he certainly wielded the sword of a free spirit, alike in his teachings and in his life.

It must be noted that Occam denied all real distinction between essence or "whatness," and the existence or "thatness," although it could be, and was, very ingeniously presented: "Existentia et essentia idem omnino significat," he says. A real distinction between them had been held by Aquinas, Albertus Magnus and others, while the distinction was treated as not real, but merely virtual, by Alexander of Hales, Durandus, Biel, and later Suarez. Duns Scotus did not treat the distinction between essence and existence as a real one, nor yet a virtual one, but regarded it rather as *formalis,* of the kind between a reality and its intrinsic modes. These divergent views, despite the difficulty of reaching satisfactory clearness in respect of them, seem at

least to testify to the desire of medieval thought to attain insight into the nature of reality.

The will is, for Occam, the essence of the soul, and he is a thoroughgoing voluntarist, as Duns Scotus also was. "Eo ipso quod voluntas divina hoc vult, ratio recta dictat quod est volendum." The absolute self-determination of the will is maintained by the critical and skeptical Occam, just as Duns Scotus had maintained that the will determines itself. Occam, however, fails to distinguish between the free act and spontaneous action. All variation in the degree of freedom is to him impossible. He renders the primacy of will over knowledge void of meaning. Freedom in God is to him that of His being arbitrary sovereign of good and evil, which is unsatisfactory enough. In so maintaining, after Duns Scotus, that the Divine Will—like the human will—is independent of reason, and that the Divine ordering of the world is purely arbitrary, Occam strangely failed to see that his position was inimical to all reasoned morality. It was on this conception of Almighty arbitrariness that Occam's positivism was finally based Occam also erred in thinking things intrinsically possible, because God can create them, instead of regarding His power to create them as due to their being intrinsically possible. But he did not err when, in the *Logic,* he offered a *Deus non posset* to making a contradiction in terms valid.

I now turn to the metaphysical concept of substance. It is easy to see that Occam's conception of substance is one that relates only to reality accessible to the understanding, and not to incomprehensible truths of revelation. It naturally thus refers only to finite substances. He says that a cause, in creating a thing, creates it only as a particular individual. For Occam, the individual is the true substance, of which there is intuitive knowledge (*nihil potest naturaliter cognosci in se, nisi cognoscatur intuitive*): the universal takes its independent form from intellectual trav-

ail. A German writer has asserted that Occam's philosophy always founders in subjectivism. That is clearly not the case. Intuitive knowledge, with Occam, always attains to what is really extra-mental (*res extra animam*): it is only the abstract concept which is shorn of connection with the things themselves. Subjectivism may be applicable to abuse of Occam's doctrine, but not to that doctrine itself; Occam distinguishes the particular from the universal by the fact that it is a substance. No universal is a substance, says Occam in the *Logic*. A *suppositum* or "hypostasis" has been used to mean a substance, complete as such, the idea of which has sometimes been spoken of as presupposing a *substratum*. By Occam the term *suppositum* is used in a different sense or meaning from that in which it had been employed by Aquinas. Thomist doctrine took the "hypostasis"—called personality in intelligent beings—to be something real, superadded to the substance, a doctrine opposed by Duns Scotus. Substance and hypostasis had been earlier distinguished as universal and particular. A person is an intelligent *suppositum*, but, as the suppositum must have a nature such that it forms a whole by and for itself, *supposita* may include other organisms than man. There is for Occam, however, no real universal besides the particular, not even in things, consequently there is for him no concept of being. So it is said in his *Logic*.[13] There can therefore be for Occam no substrate in things, from which a receptive being is to be distinguished. Occam uses the term *suppositum* after the sense of the terminology of what was considered the modern logic of that time, namely, to express that for which a word or a concept comes to stand as a *sign*. Though a term be so used as a *sign* for that which it means, the *sign* is different from the thing itself. But this significant use of the word no longer involves direct reference to the thing itself,

[13] *Summa Tot. Log.*, c. 16.

but primarily to its idea. This was part of the "terminism" which, as we have already seen, Occam developed.

Some notice may here be taken of the form of words called "Occam's Razor" for getting rid of superfluous entities—"Entia non sunt multiplicanda praeter necessitatem." This principle we have already seen at work in Occam's rejection of "intelligibiles species" as needless, and in his rejection of the distinction between essence and existence. In *Mind* (July, 1918), W. M. Thorburn noted that in nearly every modern book on logic the words quoted are given as those of Occam, but this is done without any reference ever being given to any particular work of his. He is, after search, skeptical of Occam's propriety in the phrase. The Law of Parsimony was used by Duns Scotus and Occam in certain variant forms, but Mr. Thorburn does not believe the current formula was known to Occam. He appends some quotations of the Law of Parsimony in its variant forms, one of these being "Frustra fit per plura, quod potest fieri per pauciora"—a form found in the *Summa Tot. Log.* of Occam and elsewhere. Another form of the terminists was: "Non est ponenda pluralitas sine necessitate," to which Turner's history gives a reference in Occam.[14] I shall now add another to Mr. Thorburn's list, taken from the Latin works of Wyclif. It occurs in his work "De Actibus Anime," edited by M. H. Dziewicki of Cracow, in a volume entitled *Miscellanea Philosophica* of Wyclif. It occurs on page 119 and runs thus: "Quandocunque natura potest cum paucioribus mediis in finem aliquem non multiplicat plura," etc. The editor gives reasons for saying we may "safely assign to this work a date anterior to 1361." I have dealt with "Occam's Razor" under this head only because of its metaphysical associations in general usage, although Mill declared the Law of Parsimony to be "a purely logical precept," which would

[14] In II *Sent.*, Q. XXIV, Q.

rank it with methodology, rather than with metaphysics. Still, the fact must be kept in mind that the knowledge of existence is always, to Occam, intuitive, not conceptual nor abstract; for him the real is individual, not universal. I have thought the matter worth some reference, since the formula, attributed so generally to Occam, is not referred to in works like Eucken's *Geschichte der philosophischen Terminologie,* nor in the Appendices to Harper's *Metaphysics of the School,* nor in the article on "Latin and Scholastic Terminology" in Baldwin's *Dictionary of Philosophy.*

Occam discussed continuity and the infinite indivisibility of space, it may be remarked.[15] A metaphysical feature of nominalism was that it did not hold to the independent existence of space, only to things conceived in space. Space to it was fictional, taken apart from singulars occupying space. The number of existing singulars must, to nominalism, be finite, but the number of possible things might be indefinitely great. And the same thing held true of time. The particular has, of course, relations to space and time, such as are not found in the case of the universal, yet it will be seen, from what has been earlier said, that the particular is not to Occam explicable merely in terms of space and time. Yet space and time were the great individuators to Schopenhauer, a view which requires more explication than he has given to it, before it can be accounted satisfactory.[16] Wundt does something of the same sort of unsatisfactory thing when he, in his logical treatment, makes the individual consist in the *this* of space and time—the *here and now* object. This individuation in space and time, as something which no other object can then and there occupy, does not explain the essential nature of the individual. This has, no doubt, a non-substitutional character,

[15] See "Occam on Continuity," by C. Delisle Burns, *Mind,* Oct., 1916.

[16] *Die Welt als Wille und Vorstellung,* Vol. I, Bk. 2.

but it consists in the essentially unique character of the individual, not in its particular occupancy of space and time. You cannot define individuality by mere spatial character and physical exclusion in such a way. The metaphysics of individuality would take us, ultimately, up to Divine individuating Will and Love, in the cosmic actualizations of Deity. On the other hand, the opponents of nominalism held space as for us real and unlimited, though space must always be filled by something not itself. Its ultimate parts were real indivisible points. So, too, for them time was a mode of being that implied changeable duration, but one that depended on the existence of the world. Its ultimate elements were real indivisible instants. But I have here no call to discuss the question further.

Occam held a form of corporeity and a sensitive soul in man, besides the intellective principle. In these matters he speaks mainly as a follower of Duns Scotus, and the words of Duns Scotus are these: "The substance of the soul is really identical with its faculties; so that while, in relation to body, the soul is its substantial form, it takes the name of different faculties according to its different operations." That is to say, there was no real difference (*sine diversitate reali potentiarum*), however there might be formal or logical distinction, between the faculties and the mind. The soul, "by its own substance," said Duns Scotus, is "at once the efficient cause and the subject, not by any faculty which is really distinct." Occam rejected the theory that the vegetable and sensitive souls (*forma corporis, anima sensitiva*) were identical with the *anima intellectiva* or thinking soul. Occam held, psychologically, to the superiority of intellectual intuition over that of sense. Intellect, he says, is not confined to the knowledge of *sensibilia,* but intuitively knows *intellectibilia,* which do not fall under sense (*nec sub aliquo sensu cadunt*). But such intuition he refers, it should be said, to the states of the

soul, rather than its substance. Our knowledge of the sensible and of the intelligible, thus claimed by Occam, does not, I may remark, involve that there are no conflicts between reason and sense, for these have not even yet been laid, except in too easily satisfied philosophies, even though the gulf between reason and sense was in a measure bridged so early as Plato.[17]

As to immortality, Occam shared the doubts of Duns Scotus as to the immortality of the soul being demonstrable by human reason; only faith could apprehend it with certitude.[18] It is, of course, a purely negative attitude, one which does not take account of positive arguments for immortality. But a still more negative and skeptical attitude was assumed by that latest of schoolmen, Pomponazzi, who, while arguing for the soul's mortality, in his work *De Immortalitate Animae,* went beyond his immediate scholastic predecessors in making virtue an end in itself, in anticipation of Kant. I mention Pomponazzi only because, in the controversial storm which he brought upon himself, he took refuge, like Occam, in the distinction to be drawn between science and belief.

In concluding this paper, I may observe that its importance lies in its belonging to the historical approach to the questions with which it is concerned. From the issues of nominalism and realism onward, we have seen that they concern problems that are with us to-day and in respect of which we owe greatly to thinkers like Occam. We are still discussing essence, or, as it is now called, "meaning" —where Occam and the scholastics generally spoke of essence or quiddity—whether it stands for an existent or represents the character of an object. They spoke of essence in the wider sense of including being in general, not simply the specific nature of a particular object. And of

[17] J. Burnet, *Greek Philosophy,* p. 349.

[18] *Quodl.,* I, 10.

existence, philosophers are chiefly anxious to-day to say that it is value. But our appreciation of value must not land us in any depreciation of reality. Again, in respect of the seeming arbitrariness of the logico-grammatical method of Occam and the terminists, we have to remember that, in the dependence of thought upon language, language was formed long before mental processes were interpreted by psychology. James has said that "philosophy has always turned on grammatical particles." Even yet we recognize how little conceptual thought can have its development carried through without the aid of language, especially through the formation of general concepts. The concept is conserved, grows fixed and definite, by means of the specific verbal symbol; words being, as Hamilton said, the *fortresses* of thought, even if the fixity and definiteness should remain—and desirably so in a developing order of things—no more than approximate. And this elaboration of concepts proceeds as we now recognize, through processes of attention, comparison, analysis and generalization, until universal ideas are reached.

The nominalism of Occam's time is, under restatement, now represented in the tendencies of modern empiricism, and the realism which he opposed is represented, more broadly, by modern epistemological realism. But realism has always had the object of knowledge for its concern, and is to-day mainly occupied with emphasizing the completeness of the object, without the knowledge of it. But the reality of the universal is the maintenance of realism, though we hear less of it. The empiricism, which, I have said, now represents the nominalism of Occam's time, is illustrated in Bain's denial of abstract conceptions and universal relations. Bain missed the essential meaning of abstraction, and was pretty well refuted within his own school by Lewes. Said Lewes, "In every science the concrete real is stripped of all its qualities except those which

the science needs for its construction." "The substitution of an ideal object for a sensible object, an abstract for a concrete, is the substitution of a general for a particular relation."[19] "To the geometer a circle is not the round figure visible by his eye, but a figure visible by his mind, in which all the radii from the center are absolutely equal, it is not this particular sensible circle, it is the ideal circle."[20] Later, in the same volume, he says, "The objects of mathematical study are reals, in the same degree as that in which the objects of any other science are reals. Although they are abstractions, we must not suppose them to be imaginary, if by imaginary be meant unreal, not objective. They are intelligibles of sensibles: abstractions which have their concretes in real objects."[21] "These things are fictions, but they have a real existence, though not in their insulation of ideal form, for no idea exists out of the mind. These abstractions are the limits of concretes."[22] So conceptions take the place of perceptions, but without any loosening of the hold on reality. Not only the empiricism of Bain, but the more recent empiricism of James and Dewey is unsatisfactory, alike in its default of any manner of accounting for the reality of universals, which admittedly enter "somehow" into experience, and in its inability to obviate the stark dualism of particular and universal, which faces its immediatism. One may very well agree with James that "all the thickness, concreteness and individuality of experience exists in the immediate and relatively unnamed stages of it,"[23] and yet hold the unsatisfactorinesses, which I have just indicated, to remain undisposed of by the empiricists or immediatists. For universals are not immediately experienced, nor has it been shown by the imme-

[19] *Problems of Life and Mind*, Vol. I, p. 344.
[20] *Ibid.*
[21] *Loc. cit.*, p. 420.
[22] *Ibid.*
[23] *A Pluralistic Universe*, p. 280.

diatists that they can be; they are always mediate terms of thought. We do not, in intuitive thinking, have regard to the universal element apart, or in distinction, from the particular embodiment. Universals are not immediately experienced *as such*; they are developed and interpreted in the process of speculation. We have seen how we are driven to the use of symbols; the symbol is, as we know, the creature of logic; and the symbolic always lands in a logical universal.

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LOGICAL FICTIONS.

IV.

Words, then, like other things, are symbols representing our interpretation of the external world, as we call it. And it is remarkable how often men have said that words may be mere counters with no meaning behind them and how seldom that things may also be mere counters with no meaning behind them. In *Faust,* Mephistopheles says: "Allwissend bin ich nicht; doch viel ist mir bewusst," and he tells Faust's disciple: "Von einem Wort lässt sich kein Iota rauben." We shall see presently that, far from being the permanent treasure of Mephistopheles's sarcastic teaching, a word is as hard to pin down as a thing (like the space between two trees) and it is as hard to say what a word means as to foretell what speculative shares may be worth in a year's time. For words considered as sounds or sights are physical objects that affect us (like the space between two trees) through the senses, and like other objects affecting the senses are symbols (or key-notes) by the help of which we scale our patterns. Thus considered, what we call words are fictions, just as a tree is a fiction. It is impossible to say what a word is: but all of us recognize what is a word, because it becomes a word the moment we admit that it answers to our idea of a word. As a matter of taste, taking a pedantic point of view, I may say that the phrase "pip emma" does not consist of words. As it is a matter of taste, I am entitled to select my point of

view. But if we agree to take the point of view of a cable company, taste is out of the question: and it is a matter of science whether there are any and, if so, how many "words" in "pip emma."

This is a matter of great importance in education, and we shall deal with it more fully in a subsequent chapter. For the moment it is sufficient to point out that when we allow children to read to their hearts' content, we may be doing them a great disservice. When a criminal is executed, from one point of view it may be "justice," from another point of view "a pity," from another point of view "judicial murder": from a childish point of view it may be "thrilling." It may be all these and many more; but for the child it is hard, perhaps impossible, to keep the points of view apart, and its judgment suffers. In real life we see experience from one point of view and judge from that: in reading books our judgment may be grossly warped owing to our vague view, shifting, as it may, from point to point under the influence of sentiment, until we feel sympathy for people who do things that would disgust us in fact.

But it may be argued that reading a book is only a special form of reading in its widest sense—that all experience is got by reading the external world, of which books are only a small part—and that all reading must be useful. It may be—no one will deny that. But reading books may be a form of self-indulgence in which we are too lazy to construct an adequate meaning for the symbols: that this may be mischievous may be seen if we take an extreme case, such as reading one's accounts carelessly: thus if I bought shares at $100 each and have entered them at that value, I may continue to think of them as worth $100 whereas on the market they are, let us say, worth no more than half. My symbol $100 is correctly read: but not fully, not adequately. We do the same when we trip

or miss a step or run into some one by mistake. Our reading was not complete. But whereas in what we call "real life" we get a practical demonstration of our error, the book gives us very seldom any indication of our errors of interpretation.

This means that at various stages of our mental growth we may have a varying range of what may be called "sufficient symbols." A child's interpretation of the symbol dog may be adequate for every-day purposes, if the child does not own and have to look after one: what is adequate for distinguishing dogs may not be adequate for distinguishing a dog. In the case of the owner of the dog the bark or the appearance would become an adequate or sufficient symbol: any one else might have to look at the name on the collar. In other words, symbols of all kinds (including what are called natural phenomena and words) give rise to various constructions under various circumstances. Strictly speaking, circumstances always differ; hence we may see the "same" symbol twice and consider it in the light of two different scales. Thus we see (as it is called) the same thing, but the thought is not the same. For example, a face may cause us to think of beauty, age, health or character. If at any time we resolve to see faces in the light of some new scale (say "a typical English face") we shall find in ourselves a new interest. And when we speak of encouraging the young to use their eyes, what we are really asking them to do is to see symbols as suggesting position on some scale, the nature of which we often forget to explain. It is of little (if any) use to see patterns (such as a track) if we do not connect it with another pattern (such as fox or bear) which supplies the scale. This consideration introduces the idea of "use," which brings out what was implicit in the term "sufficient." The formation of patterns, as we have seen, is largely a matter of emotion. In the same way the com-

bination of patterns is the result of interest or passion: fear, hunger, lust, and interests that have their root in these passions, are largely responsible for what may be called the adjectival attitude. For instance, a horse may be thought of first as "one"—"horsy one"— then *white* if we are interested in color, *tall* if we are interested in size, *worth much* if we are interested in price, *the property of a fool* if we are interested in buying it; every new pattern or scale that is added classifies or limits the original pattern from a new point of view, and if we shift from one to another it is at the prompting of some interest or passion.

Thus it appears that our thinking proceeds from the recognition of patterns, the discovery of the duties that are to be expected from our instances and the combining of patterns with patterns for the purpose of scaling them. Thus we recognize instances of "cat": we learn the duties to expect of every instance: we learn to locate any instances in space, time, size, breed, color, temper, age, value and so on.

This being so, it is clear that the difference between quantity and quality is a difference that rests entirely on convention and has no logical foundation whatever. Both quantity and quality, as usually understood, are scales, and both are mathematical: and there is no reason why a scale should be looked upon as giving quantity accurately (i. e., by measure) and quality vaguely (i. e., by impression). We give both quality and quantity as accurately as we want to. Thus I can say there are about 100 men, or that some one's work is excellent; but if I were required to do so I could state my measurements more accurately, *103 men*, and of all the work I am thinking of *the third best*. It will be seen in a later chapter that what we usually call positive adjectives are not positive: a positive adjective is not an adjective in the ordinary sense of the word, it is a part of a compound noun. A good shoe is similar in logic

to a horseshoe unless we are laying stress on "good," and in that case it means a *better* shoe. We get a blackbird or a black bird: in the second case the black clearly gives a color scale, just as bird gives the creature scale: but in blackbird the black is part of the pattern and gives no scale, as is seen more clearly when we speak of white wine.

The common assumption that mathematical, musical and scientific symbols are accurate, whereas the symbolism of language is vague and full of shades of meaning that cannot exactly correspond to the so-called complexity of life, reality, the universe and so on, is a superstition that has given a commission to much nonsense. The mistake lies not in thinking that ordinary language is vague and full of shades of meaning, but in thinking that mathematical, scientific and musical notations are perfect or accurate enough for all purposes. All these forms of symbolism work in the same way and are liable to the same defects. All start with patterns which are subjective and have to be connected with arbitrary symbols which may be subjective but are usually "We" symbols: and all these patterns are located by means of various other patterns (likewise subjective and connected with "We" symbols) and thus scaled as accurately as is required. Any mathematician, musician or scientist will admit that he works with symbols that are rough and ready—often far too much so; what is not so frankly admitted is that all these, together with the symbols of language, are rough and ready in the same way and for the same reason, because they are all essentially of one kind and work in the same way.

So far, then, we have seen that a word in the widest sense (including such symbols as H, 2, C♯) represents a pattern and is meaningless unless scaled by means of another pattern. H, 2 and C sharp ***mean*** nothing until we can scale them. Or perhaps it would be better to say they can mean nothing useful: for undoubtedly if we rec-

ognize something as hydrogen, we have the meaning that that *one* is a hydrogen one, by which I mean that that, in my opinion, will behave in a hydrogen way, which I could not do intelligently without knowing something about hydrogen and thus being able to scale it with such patterns as gas, matter, density. And this brings us back to the consideration of the behavior of our patterns, for we expect duties from them in order to be able to tell what happens on the time scale. The space scale is of vital importance to us if we wish to avoid accidents and to survive; the time scale is as important but in quite another sense: it is conceivable that it is the invention of a time scale that gave man his great advantage over other forms of life.

The conception of time has become so habitual with us that an educated man has to undergo a special training in order to think without it. It is true that the uneducated still use a very primitive time scale; but the uneducated take no part in building up any conception of the universe that would help them to explain the past or the future to any one's satisfaction, except perhaps in some narrow field of knowledge, such as husbandry or sheep rearing.

We have already seen that the popular idea of time covers two distinct things: there is, on the one hand, the present which is outside time altogether; on the other hand, time which is a pattern like any other and supplies a scale which (owing probably to its origin) has before and after aspects which are purely spatial; and it is curious to note that the time scale has much more of what is commonly called space than the space scale. The hope of ever discovering the origin of such a conception as time is no doubt vain. There can be little harm, then, in conjecturing that it arose from the fact that men lost themselves in deserts or on the high seas. In both these places the space scale fails: one is not interested—or rather there is no use—in knowing *where* he is, but it is profitable to

know *when* he is, whether at the third or fourth or fifth day's lapse. Such distances were not measured by space but by a more useful scale of time, and the mere fact that the space scale measures the tangible and the time scale the intangible gives some idea of the stride that was made by the first men who learned to use a time scale.

Popular superstition attributes a measure of reality to the "past" which it denies to the "future": it is important to recognize that this is nothing but a convenient fable. In practice and in theory it is necessary to work from the assumption that the only knowledge possible is in the present, but that by means of patterns and scales we can get the conceptions of a here and a there, a now here and a now there. Later we shall get a conception of what lies between here and there and between a now here and a now there. By this time we shall be well on our way to an intelligent view of the universe, but no amount of progress would ever make the past or the future visible: both the past and the future are constructions made subjectively (with "We" patterns, it is true) in the present, and of the two the future seems the better known, for our construction of the past is one which (by definition) is not so readily tested or verified. The babblers and gossips are the great authorities concerning the course of history yesterday: he who dares to tell the history of to-morrow must weigh his words and understand to-day as only a wise man may.

V.

As a boy I was brought up on mysteries. Faith was a virtue. And I was made to feel ashamed of harping on such grammatical questions as: "Why *three* persons?" I felt that two would be sufficient, and I still think that any open-minded grammarian must admit that there can be only two. It was also a riddle to me why in such a sentence as: "The dog bit the cat," the dog should be called the

subject. I saw the necessity of saying so for the purposes of examination: but when a master started to explain that it obviously was so, my instinct rebelled: for it was obvious to me (and still is) that, if that sentence had a subject, it was the biting, and that dog and cat were merely plus or minus adjectives "qualifying"—as we used to be made to say—the bite: for the bite is either a dog bite or a cat bite as the point of view shifts from the dog to the cat, and from an unbiased point of view, it is dog-cat biting; and the tense of it is merely the result of perspective due to the historian's point of view.

I would not for a moment deny the existence (or the charm) of mysteries. I am old enough to have discovered (and may be my sons have too) that mysteries often begin where a man's explanations fail. I admit that dogs and cats and bites are no less mysterious when parsed idiotically; nor are two persons less mysterious than three. What I want to argue and, if possible, prove, is that infinity and eternity are no more and no less mysterious than cats or dogs. In other words, I claim to be able to know just as much about eternity and infinity as I do about dogs or cats.

Everybody understands that you can go on counting the cardinal numbers forever and ever—and you can go on halving the half forever and ever. It is the forever-and-ever that is supposed to stagger the imagination. And yet there is nothing that we can think of that has not this forever-and-ever tail. Time ticks theoretically forever and ever; space is limitless; our bread and butter is infinitely divisible. It does not require much thinking to discover that everything we think of is infinite, but that it is impossible to think of it unless we think of it as finite. An ice cream is no more obvious and elusive than anything else: any child can tell us what is an ice cream, no scientist can tell us what it is. Any fool can tell what is Germany: will any one tell us

series to which that member belongs. And *virtue* is meaningless unless you have a notion of the plus and minus neighbors which define it and thus furnish an equation.

It seems as if thinking is done by instinctively escaping from the infinite, much in the same way as Noah's wretched contemporaries dodged the flood for a while by finding effective spots. And infinity itself is perfectly conceivable, so long as we think of what is infinity, and not of what infinity is. I defy any one to tell me what a flood is: but in Noah's time even the children knew what was the flood.

For though what we are conscious of is infinite, we can concentrate our attention on some part: and that is called thinking. The field of consciousness thus defined is recognized as a pattern and can be, as we have seen, located on scales. What we call science begins in the discovery of another pattern which is different or another which is similar. These patterns are known to us only in their context which is infinite. But they are thought of with the infinity left out, much as bank returns may be given with 000,000 left out. We use 6, understanding that we mean six millions. So we use a pattern, let us say *fire*, understanding that we really mean *fire* + an infinite context. In recognizing that patterns are different we discover scales; when we scale patterns we are treating them as if they were similar. The moment we have differences and similarities we are dealing with what can be dealt with mathematically. It is commonly believed that we can count dogs; but it is impossible to add three dogs, and it is impossible to add a dog, a headache and a total eclipse, until we discover some common abstract by which they can be called three.*

It is natural, but risky, to assume that a prompt answer means much knowledge. If an examiner asks a child to say what it knows about either an acrobat or a micro-

* In fact you can count and name things only if you pretend you know only one thing about them, namely that they are "the same," which they are not.

scope, the common assumption would be, that, if both were familiar words, the choice of one would indicate that less was known about the other. But it is not paradoxical to say that it is easier to explain the "less known" than the "better known." For, putting aside the special case of examinations in which explanations are right if they satisfy the examiner, we may say that it is never the function of an explanation to explain: it is the function of human explanations to satisfy. (What happens when "things explain themselves," we need not stop to consider now.) The more we learn, the harder are we to satisfy: hence the common lot of all thinkers, who, like Faust, feel desperately lonely as they approach a position (which must be God's) where no explanation whatever satisfies. The strongest argument in favor of the doctrine of original sin is that human beings seem naturally hard to satisfy—children show it. Fortunately we have education to assure us that knowledge is bliss and that 'tis folly to be agnostic.

Or, again, we may say that the progress of science implies the reduction of knowledge. In this sense. If I had lived in the good old days when science had not progressed much, I should have *known* that all things were made by Jove; therefore, my kittens were made by Jove. Science would have progressed and I might have learnt that Jove made only white kittens: the black ones clearly were attributable to Pluto. This looks like additional knowledge. But sooner or later I should have come across a kitten white and black: who made it? And I begin to regret the blissful days when I *knew*. My ignorance becomes still more profound when I discover one fine day that a cat makes a kitten: it becomes almost intolerable when I realize that it takes two cats to make a kitten. And I go down in sorrow to the grave, wondering what it takes to make two cats.

However, in spite of the progress of science, most of

us still behave in ordinary circumstances as if we were wise. In spite of my ignorance, I go into a baker's shop: and although I have no idea what bread is, I am probably content to accept what is offered as if it were bread; I feel that I know it is bread, though I don't know what bread is; I see it weighed, and although, in my ignorance, I cannot tell what immeasurable error there may be, I am content to accept it, as if it were a loaf.

What is it that enables us to do business so confidently in such a field of ignorance? Surely, those finite patterns of which I spoke. I go into the shop having three definite patterns: bread, loaf, loaf of bread. If I get something that answers to those patterns, I am satisfied. If I can concentrate attention on the infinite context that surrounds me and I find something that I can accept as answering to my pattern bread, I say that I know that that is bread.

My small boy (aged 2) is an authority on the cat pattern. He spots them all over the place. But a good many spots of the infinite context which fit his cat pattern—and he *knows* they are cats—would fit patterns which I call bears, tigers, leopards, panthers, etc. What I call a lion pattern is still a cat for him; but he has doubts: his ignorance is increasing.

Such a pattern has to be developed by each individual for himself in response to the stimulus of what may best be called an effective spot in the flood of consciousness.[1] What makes the spot effective is a question concerning which physiologists are displaying an ever-growing ignorance. The process is most intricate: it requires the utmost patience and courage to refuse to call a halt and to refuse to

[1] Mr. Bertrand Russell in a recent article says, "I shall continue to protest it was not I who made the world." Sure! But he need not have protested so innocently: there was a time when he came very near thinking it himself. I gladly take this opportunity of testifying that I can see no reason for thinking that Mr. Russell was in any way implicated in the creation of what I have called the infinite context. But I hold him to be entirely responsible for the effective spots he has noticed and also for the names which he gives to these colonies of his mind.

be satisfied . But at the risk of being too easily satisfied, I fancy that consciousness must—at any rate for some time to come—be explained in terms of positive and negative pressure. An apple touched by the sunlight turns red and a sunflower turns round. Apples and flowers may be slow thinkers, but it is hard to escape the conviction that this "turning" has something to do with what they think is the sun. Everything (at present) points to the conclusion that what we call the sun is known to us only because it has an effect *in* us, just as it has an effect *in* apples and flowers. We are all like the dog in Æsop's fable: we think the meat is in the surface of the river: we see the meat in the river and are blind to the meat in our mouths. Fortunately, we cannot drop the meat; we deal in practice with the real piece; but we think we are dealing with the reflection. Hence our little troubles when we argue about cause and effect.

For the moment we must be satisfied that nature is known to us only in effective spots to which we give quite arbitrary but convenient names, as soon as the spot has made its impression on us in the form of a pattern. The name is arbitrary because it cannot matter whether I call a particular pattern a dog or a bow-wow. It is convenient because if I want to order a dog I can count on not receiving a wolf. If I am not satisfied with *any* kind of dog, I shall require a more convenient name, I may even want one particular spot: in that case the name becomes arbitrary and proper. But it is obvious, at least to me, that there is no *logical* difference between the group containing all dogs and the group containing one dog. (I admit there is a difference, and I would be satisfied to call it a *political* difference.) I could, and I do, continue to give arbitrary and convenient names to various portions of the dog, and if it were necessary, I should give arbitrary and convenient names to each of the hairs. This statement may seem ab-

surd in those who are misled by the ease with which we ignore differences—leaving them in what I called the submerged portion of the dog. There is nothing staggering in the idea of infinity: but the infinite difference between two hairs, or two dogs, or any two things which you and I calmly count and call alike, is enough to and does stagger the most robust imagination.

It should now be clear that infinity and dogs, *as such*, cannot be said to exist. We have an effective spot, which, if it fits our pattern dog, *is* a dog. What a dog *is*, is, as we have seen, inconceivable. There appears to be some reluctance to admit that a thing cannot exist as a thing, until some one recognizes it as a thing. When Cain slew Abel, Abel was not a corpse until Cain saw that he was. The case may be illustrated thus: a drop exists in the ocean, but not *as a drop* until it is separated from the ocean. So things exist, as it seems, in the ocean of what we are conscious of, but they do not exist *as things* until we pick them out, until they have become patterns (effective spots). The Great Bear is a pattern that exists only because and if we see it: I have known people who could see the stars, but could not see the pattern. It is also possible—though undoubtedly rare—to be unable to see the orthodox pattern *dog*. Or we may illustrate it thus: in a perfect mirror the reflection would be an exact reproduction of reality: how do we always know that it is a reflection? Because of the border—the limits of the mirror. An image in a mirror without a boundary could not be distinguished from reality. Large mirrors are notoriously deceptive. It is likewise possible to think because our thought has a border or is limited. We know that a thing is "there" in much the same way as we know that the reflection in the mirror is not real, namely, by means of the border which enables us to see that it stands out against an indeterminate context which we can ignore.

In a short essay it is not possible to do more than suggest the outlines of an explanation that might satisfy us to-day. But it may be useful to lay stress on the fact that progress in the past has been seriously hampered by the "knowledge" that reason is responsible for our patterns. I do not deny that patterns can be formed reasonably: it is perhaps possible to consider a decimal point in an entirely reasonable way. But most of our patterns are formed (or informed) by emotion, and the adjectival frame of mind (as revealed by the man who called decimal points "those d—d dots") is very common and quite unreasonable. It seems that reason (which has always been ludicrously overrated by rational and irrational people, just as beauty is overrated both by the fair and the plain) is a very small, perhaps negligible ingredient in thinking. There may be an entirely reasonable way of thinking of mothers-in-law: but sons-in-law have been known who think of "dear granny" in the presence of their children; of "your foolish mother" in the presence of their wives; and of heaven knows what in private in moments of depression. These aspects of the same effective spot overlap, and they run into one another like wet water-colors; the resulting blend is what the mother-in-law pattern becomes—reason being entirely blurred. In the same way, children have to deal with certain effective spots which interest them greatly. They might form quite reasonable patterns, but propriety compels them to form one pattern for public use, and some interest of the type described as analerotic in the blunt, frank language of psycho-analysis, compels them to form another pattern for secret use. The one may be called an "I" pattern, the other a "We" pattern. The combination often produces startling results. We may laugh at a dog's response to the sound "rats!" But his antics are not a whit more emotional than most (I mean *most* and had almost said *all*) of our interpretations of effective spots. We

recognize that no one can explain (to everybody's satisfaction) what is humor. What we admit in the case of humor, we refuse to admit of all things. Yet, just as nothing is humorous unless it strikes us as humor, so nothing is a thing unless it strikes us as such. There is nothing in the sequence "Getting on, getting honor, getting honest" that would help us to decide whether it is a reasonable life's purpose. But there is no doubt whatever that if it strikes us emotionally as being reasonable, it is reasonable. Who says so? *We* say so, or (very rarely) I say so.

I say *very rarely*: I should prefer to say that we are never logically justified in using the first person singular. The ego, about which so much has been so confidently written that one would suppose it had been vivisected, is a palpable fiction: the mischief is that philosophers concentrate on the palpableness and ignore the fictiveness. Nature, in practice, is said to abhor a vacuum: society, in practice, abhors an ego. The few that blossom and bear fruit do so behind the walls of our asylums or prisons. A man is said to be insane if he really uses the pronoun I in preference to the pronoun We. It is psychologically absurd to put a creed in the first person singular. People who really believe in a singular creed are called singular. The ego is not acceptable in the pure state: it is the correct blend of the I and the We that produces the good citizen. Blessed is the man who can truly say that his I and We patterns are the same.

We have said that a pattern must be definite, but only in the sense that "English people" is definite. The composition of a pattern is constantly changing: like the "English people," it may in time consist of an entirely new set of individuals, without ceasing to be itself. A swarm of gnats on the wing is difficult to paint: you may paint in all the gnats with utmost care: you won't be satisfied: you've got

everything except the living, moving *swarm*. You've got the individuals, not the crowd. And though a pattern is composed, as it seems, of single experiences, it is not the sum of those experiences, it is the swarm of them. It is indeed a number of notes, but also a phrase. Its characteristic property is as elusive as the difference between a regular polygon of a very great number of sides and a circle.

Seeing, then, that a pattern is always conceivable, for it is essentially a conception (emotionally conceived), we have still to deal with the question: How do we know when an effective spot fits a pattern? What is the process by which a child in his second year can spontaneously jump to the conclusion that a picture of a cat in a cheap illustrated paper is the "same" as a live cat?

This is a most astonishing feat. I may be conceited, but I sometimes visit picture galleries and I stand wrapped in pleasure at my wonderful cleverness in guessing every object in a picture: and I go out into the crowded street and find I can do it just as well there, although half the objects are moving—. If nobody else could do it. . . . In all seriousness, how is it done?

We cannot in this article do more than paddle on the edge of this deep question. More than a step or two and we should be up to our necks in it. For the moment you must allow me to use the word "expect" without explaining it. If an effective spot appears and I can fit it to a pattern—in other words, name the effective spot—I am succinctly asserting my conviction that it will do its duty. Whatever we think of as a thing is thought of on the basis of expectation that it will do its duty. Being puzzled by a baby's recognition of a "cat" in a very indifferent picture, I tried to discover what duty was expected. I found that the pattern "cat" was, after all, an "I" pattern and not the orthodox "We" pattern, as I had at first supposed. Some

effects, which I thought were unmistakably cats, were ignored: and one effect, which I took to be an engine, was emphatically declared to be a cat. In a few minutes I had satisfied myself that it was *the tail* (or smoke) that fitted the cat pattern: that was the duty expected of a cat—the remainder of the cat as seen alive seems to have been considered (if at all) as an irrelevant appendage. If you analyze what the average Englishman means by Russia, you'll find much the same performance.

Now, why do we expect? In answering this I enter rashly in where physiologists fear to tread. But a tentative answer may convince you that infinity is for most of us a less subtle conception than dog. There seems to be only one way in which we can expect a duty. It is betrayed in every effort to explain the duty we expect of God: namely, by anthropomorphism. We are in the pattern and act as if we were the pattern: hence we know. Sometimes the effective spot does not do what we expected of it and then we give it a new name. A good example of this is the name X-rays given to rays that did what they were not expected to: the name implying that at the time scientists did not know what to expect of them. Nowadays we feel quite confident that we should know how to behave if we were suddenly turned into X-rays—which indeed we are, in a very real sense, whenever we recognize them.

If that is so, it is clear that most of us recognize (or are for a moment turned into) dogs far more often than we are turned into infinity. Hence the duty we expect of infinity is a simple one (for us, not for mathematicians!) compared with the manifold duties we expect from our dog pattern.

To sum up. Whatever the pattern, it is by nature conceivable: whatever the duties expected, they cannot explain, but they must satisfy. There can be no progress, no change in the quality of our knowledge: what was once reported

to be one thing is now officially presumed to be another. What changes is the quality of our satisfaction: what would have satisfied the greatest of our ancestors fails to satisfy thousands living to-day. It is not easy to see why we should suddenly be becoming so rapidly harder and harder to satisfy. It looks like a fever that civilization may die of.

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EVOLUTIONARY NATURALISM AND THE MIND-BODY PROBLEM.*

NO problem is more crucial for a naturalistic view of the world than the mind-body problem. Here the physical world and mind somehow unite in a functional whole. Separate them as much as we will in our abstract thoughts, they refuse to remain separated in reality.

The way in which the mind-body problem has been conceived—both as regards the terms and as regards their supposed relations—has been due to ideas of a very general nature. It has reflected assumptions which for various reasons —to be understood only historically—have dominated the thought of the day. The traditional attitudes taken toward this problem are speculative and bound up with the general bewilderment in philosophy. On the whole, it was assumed that mind and body are existentially separate, and so the question came to be that of their causal relation or lack of causal relation.

The task of the present chapter will, therefore, be twofold. We must show the false premises upon which the old dualisms were founded, and we must render *intellectually conceivable* the functional presence of consciousness in the human organism. We must try to do as clearly as the difficult subject permits what materialistic naturalism

* [Like the articles "The Status of the Categories" and "Space and Time" in the April and July numbers of *The Monist*, the following is taken from a volume on *Evolutionary Naturalism* which we expect to publish next spring. —Ed.]

of the older type with its intuitionalistic idea of knowledge and its lack of appreciation of organization and novelty could not accomplish.

The view we shall adopt in our approach is that the mind-body problem, not being specific in the experimental sense and being entangled with all sorts of conflicting assumptions, is largely a philosophical venture. What is required is a clear analysis of the terms and of our knowledge of them. A point of view must be achieved from which the well-grounded generalizations of the physical and the mental sciences can be harmonized. It is obvious that such an achievement is impossible without an analysis of fundamental categories. The greater part of this work has already been accomplished. Our present task is to apply these results to the mind-body problem.

Such, if I mistake not, is the logical situation of the mind-body problem and the reason why philosophers must have a peculiar interest in it. But if philosophy is to be a coordinating science resting upon, and cooperative with, the special sciences, its interpretation of the problem must reflect the march of events in these sciences. It cannot isolate itself in the old romantic fashion and trust solely to the powers of dialectical speculation. Its hypotheses must spring from the pressure of the general scientific movement and reflect in their growth the point of view and the fertile suggestion which such pressure gives to the creative imagination. But, added to this, philosophy must contribute a clear analysis of the actual content of experience and a sharpened notion of cognition.

Traditional Solutions.—The traditional solutions of the mind-body problem have a metaphysical parentage which goes back to the early days of modern philosophy. Dualistic theories have a Cartesian flavor, while monistic speculations are tinged with Spinoza's postulation of a funda-

mental substance with two knowable attributes. One of the perplexing features of the modern forms of dualism and monism is their vagueness in regard to substance. It is often difficult to determine just how far they continue to retain the Cartesian or the Spinozistic ontology. This very fact shows their weakness; they are compromises between tradition and empirical facts.

Parallelism of this metaphysical temper would maintain that mind is a thinking substance, that is, a self-subsistent entity whose essence is thought. Body, on the other hand, is a substance whose essence is extension. Being, by definition, absolutely different in nature, their relations become meager and practically unthinkable. It will be remembered that Descartes admitted interaction, although he could not really explain it or conceive it satisfactorily.

Spinozistic monism has never been satisfactory because it implies a notion of substance largely outgrown. Substance *as the self-existent* is combined with a logical notion of substance as the *subject of attributes*. But the union in this transcendent substance of the attributes, thought and extension, seems verbal as soon as this logical notion of substance is rejected. Valuable as a development of Cartesianism, it has insuperable objections to face.[1]

Like metaphysical parallelism, interactionism has usually been a dualistic theory maintaining that mind (or soul) and body are distinct existences of alien natures which yet act upon each other in perception and volition. There is hardly less of the old dualistic tradition in interactionism than in parallelism. The mind or soul which is said to act upon the brain is regarded as a substantial entity of a unique sort. It is, of course, this assumption which it has in common with metaphysical parallelism that the evolutionary naturalist will not grant. May not the mind be a

[1] See Stumpf, *Leib und Seele*, p. 16. The objections summarized by McDougall are worth close consideration. Universal parallelism does not have a factual foundation.

term for the integrative action of the nervous system? And may not consciousness be connected up with such action in an intelligible way?

We must distinguish the dualistic type of interactionism, which postulates two kinds of existences, from the empirical, psychological form. Often the psychological interactionist is simply championing the *efficacy* of consciousness and has no clear idea of what, exactly, the physical world is or of the relation between it and consciousness.

When we speak of interactionism, however, we shall mean any position that assumes a metaphysical dualism and still asserts a causal relation between the kinds of reality. Such interactionism has kinship with the soul-theory, and its advocates are usually, if not always, animists and vitalists. Thus a belief in the efficacy of consciousness is not enough to label a thinker an interactionist.

The older theory of the soul made it an immaterial substance underlying consciousness. When Locke made this immaterial substance a permanent unknowable, he gave the soul a shrewd blow; especially so because of his empirical idea of personality and personal identity. Contemporary advocates of the soul-theory for this reason fight shy of the term substance. They do not believe in a transcendent, unchanging substance. *What they do affirm is the need for something other than the body.* As existential theories, parallelism and interactionism agree in this affirmation. And it is, of course, what we are going to attack. Thus interactionism is just a more daring dualism than parallelism. It asserts a causal relation, while parallelism refuses to do so.

Let us glance at some of the difficulties confronting metaphysical interactionism. Physical things are always spatially related, and causality in science implies this background or context. But the soul acts *into* space rather than *in* space. This is the fundamental objection, but there

are others which develop it. First, does not interactionism imply a denial of the constancy of energy? The brain-event acts upon the soul, and the soul reacts; and so the physical system ceases to be self-contained. Secondly, the soul either acts without the need of energy or it possesses its own peculiar and spiritual kind. And yet bodily nourishment affects the activity of the mind. So does sickness. Who does not feel the essential truth of Gissing's reflections: "The very I, it is plain, consists but with a balance of my physical elements, which we call health. Even in the light beginnings of my headache, I was already not myself; my thoughts followed no normal course, and I was aware of the abnormality. A few hours later, I was but a walking disease; my mind—if one could use the word—had become a barrel-organ, grinding in endless repetition a bar or two of idle music." Does not the dualism seem to be an illusion due to some weakness in approach and formulation, to be confusedly verbal rather than real? Thirdly, how does the soul know when and where to act upon the brain to produce desired results? It would seem necessary to assume unconscious knowledge of the minute structure of the brain, and that by something other than the brain. We are thrown into the clutches of the mysterious with a vengeance. Even Bergson with his instrumentalist theory is forced to hold that brain and spirit overlap in pure perception. Fourthly, whence comes the soul? Why does it accompany organisms? Does it assist in the synthesis of these organisms, as vitalism suggests? Do souls have their embryology and development? Why are souls and bodies as fittingly connected as if both had the same heredity? Fifthly, by what right is it assumed that the brain cannot perform those functions assigned to the soul as an imperceptible thing? May it not be that the soul-body dualism of tradition is at work in this conviction that there must be two things instead of one?

The modern exponent of interactionism is practically always an animist and a vitalist. Thus McDougall writes: "It is just because we have found that mental and vital processes cannot be completely described and explained in terms of mechanism that we are compelled to believe in the cooperation of some non-mechanical, teleological factor, and to adopt the hypothesis of the soul."[2] Let us bear this reason in mind. Evolutionary naturalism does not believe that the higher levels of nature are purely mechanical; it accepts critical points with resultant new properties. The struggle between animism and naturalism centers here.

But there are some thinkers who frankly identify the soul with the self as a unitary system of experiences and refuse to admit the necessity for a *thing* with capacities. Yet the difficulties confronting this purely experiential conception of the soul are many. Is the soul intermittent? Can it cease to be, as in sound sleep, and be reborn identical with what it was? What is the basis of retentiveness? Yet we must again admit that this empirical analysis of the soul must be recognized by naturalism. To cover the facts is one of the basic requirements of an adequate naturalism. There is much to suggest that empiricists who are dualists are so as the result of a false epistemology and a resultant underestimation of the living organism. While animists are firm believers in the mechanical theory of the physical world, empirical interpreters of the soul are apt to be naive realists also.[3]

The Empirical Difference between Interactionism and Parallelism.—When we shake our thoughts loose from the older substance-theories and ask ourselves just what the empirical difference between interactionism and parallelism is when these are taken as working hypotheses, we find

[2] McDougall, *Body and Mind*, p. 365.

[3] I am referring to Laird's excellent book entitled *Problems of the Self*.

that the main divergence concerns the efficacy of consciousness.

Interactionism intercalates mental states between the incoming stimulus and the outgoing motor discharge and so breaks the continuity of the physical series. Strictly speaking, this intercalation is in the brain, so that the mental state, be it image or meaning, comes between two brain-events. To those who object that an image can have no causal grip on the brain of the external or transeunt sort here implied, it is answered that transeunt causality is a mystery which must be accepted.

I have already offered a number of objections to interactionism. To these I would add the suggestion that mental states are unthinkable apart from the body of whose functions they seem to be an inseparable expression. Cannot the mental state be given a setting in the brain of such a character that its efficacy does not involve a discontinuity and action from outside? Interactionism would appear to champion a truth, but to do so clumsily just because it is dualistic.

Empirical parallelism differs from interactionism on two points. First, it asserts a temporal correlation between mental state and brain-event. Every mental state has a correspondent brain-event. Interactionism, on the contrary, regards its intercalated mental states as literally self-sufficient. There is only one *mixed* series instead of two parallel series. Second, parallelism holds to the inefficacy of consciousness so far as cortical events are concerned. The two series do not interact. As I have already suggested, parallelism would appear to champion a truth in so far as the first point is concerned—though this correlation cannot be proved in any direct fashion.

The naturalistic view which I am going to develop has as yet no very good name. It holds to the effective presence of consciousness as a natural ingredient of function-

ing cortical systems. In one place I have called it the unity-theory,[4] but that term expresses only one side of the position, viz., the denial of dualism. From another angle, it can be called a critical development of the double-aspect theory. To the student of mind-body literature, one thing is plain: we ought to shake ourselves loose from conventional solutions; they contain too many assumptions.

Why has Mind been Excluded from the Organism?—Until very recently, dualistic theories have been in the ascendent. The reasons for this exclusion of mind are worth study.

The first reason may be called epistemological. The physical world is the object of scientific knowledge, while consciousness is the seat and means of knowledge about it. This contrast is readily taken to be an ontological contrast. I presume that this interpretation is made easier by the tendency to believe that the very stuff of the physical world is revealed in knowledge of the physical realm. Scientific realism takes the form of an intellectual intuition of things. Thus a naive epistemology is the inevitable generator of a naive dualism. Two realms seem spread out before the gaze of man: the realm of consciousness and the realm of physical things; and it is so easily assumed that they are given in a comparable way. Hence, to say that body has anything in common with consciousness is like saying that black is white. The difference is held to be almost inspectional in type.

The dualism suggested in this way is supplemented by a logical motive. The categories which develop in our knowledge about the physical world are not identical in many respects with those which characterize consciousness. I presume that the one striking exception generally admitted is time. Hence, the two general objects of thought

[4] *The Essentials of Philosophy*, Ch. 22.

cannot be identical. Consciousness is not simply the physical world, and the physical world is not simply consciousness. It is natural, then, for the logical motive which shows a disparity to be interpreted along the lines of prepossessions awakened by the epistemological motive. It is forgotten that there are other possible existential relations besides simple identity.

The third motive may be called methodological. There has been a working dualism growing out of the data of the sciences. This has meant an ignoring of questions of the nature of consciousness as not relevant to the *content of knowledge*. The scientist's cognitive interest was in the physical world and not in consciousness; and in the world so known through the data of observation he could find nothing which reminded him of consciousness as he understood that term. The point is a somewhat subtle one and to some extent involves the first motive. Consciousness was often conceived as something which could be perceived if it were *in* the physical world. By naive realists—or at least intuitionalists of a conceptual sort—the physical world was thought of as something directly observable; and the tendency was to assume that consciousness, also, was something of like possibility; why could not consciousness be perceived if it were there? Need I point out that the critical realist affirms that this whole argument has no validity? The physical world cannot be intuited, for what we perceive is the content of perception; and the recognition of this situation makes it absurd to seek to perceive consciousness as an object in the sense that the physical existent was supposedly perceived. Even were consciousness in the physical existent, it could not be perceived in the naive sense, for no part of the existent is intuited in this sense.

But still another methodological motive was at work in the science of the past. Let me put the situation in the

following way. Most of us, I imagine, would be inclined to say that there is neither mind nor consciousness in inorganic nature. But science was for many years an investigation of inorganic masses. Only lately have the natural sciences gained a fair measure of autonomy and self-confidence enough to suggest new categories. And if the dominant sciences were physical and chemical and dealt below the level of the organism, it is not strange that the category of mind did not appear as involved in the data and their necessary interpretation. The absence of mind as a category is just what we should expect. And since evolution was not taken seriously, the conclusion drawn was that all phases of nature could be understood without the idea of mind. As we shall later see, behaviorism is unwittingly raising the question whether this be so.

A sort of pragmatic dualism grew, then, out of the stage in which science was. Scientists did not feel that mind and consciousness were relevant to the physical world as they knew it. Reinforce this methodological motive by the epistemological and the logical motives discussed above, and the strength of dualism can be appreciated. Yet, on the other hand, it is not without significance that scientists, when speculative, endow matter with the potentiality of life and mind.

New Tendencies in Science.—Within the last two decades, new tendencies of a genuine interest to philosophy have been declaring themselves. These are, (1) a questioning of the adequacy of the laws of mechanics for any field of nature except that of molar masses; (2) the increased recognition of the empirical autonomy of the various sciences; (3) the admission of creative synthesis in nature with accompanying critical points and new properties; (4) the rise of behaviorism as a physical science bringing human conduct into the physical world.

The implications of these tendencies are fairly obvious, yet it will be some time before they are frankly acknowledged. I want to suggest particularly their bearing upon the idea of continuity. The emphasis previously was upon sameness. New could not come out of the old. Identity precluded differences. But has not this point of view weakened? Genetic continuity seems to us to unite striking differences. We are confronted with *pluses*. Chemical properties are not the same as physical properties. There is a further plus when we examine the functioning of organic tissues. The older properties are transcended and included. And behaviorism is suggesting that a still more synthetic level is reached in the nervously controlled action of the whole organism.

Evolution seems, therefore, to contain two equally real elements. There is genetic continuity, and there is novelty. Such change is a critical growth within reality. Who has a right to say *a priori* how great a novelty may arise and so set limits to the possibilities of nature? The extent to which this recognition of evolutionary synthesis has come to the front of late is surprising. It means the frank admission of novelty without an appeal to a superphysical agent. But if we accept the effectiveness of new organization, the rather abstract and dialectical choice between mechanism and vitalism becomes a fallacy of incomplete disjunction. A richer and more empirical approach to biology has opened before us.[5]

If totality and self-regulation appear as undeniable features of the economy of the organism, they must be recognized as such. This relevance of data to categories and of categories to data is the foundation of the true logic of science. There need be no fear that this empirical auton-

[5] Though many of Lodge's criticisms of the speculative naturalism of Haeckel are just, his own suggestions are full of a belief in discontinuity of a dualistic type. It would be difficult to connect his view of life with biological investigations. See his *Life and Matter*.

omy of the sciences will involve disorder. Out of it will come a truer appreciation of the working and genetic possibilities of nature than could be fostered by a rigid and doctrinaire mechanicalism.

Lastly, the development of psychology has led to an increased recognition of its biological foundation. If the behavior of an organism is empirically different from that of an inorganic body, this difference must be admitted. Again, there are obvious differences of capacity in the organic realm. Psychology but confirms the rough conclusions of every-day life when it points out differences of capacity in the animal world.

The Thesis of Evolutionary Naturalism.—The evolutionary naturalist desires to throw off the spell of outgrown categories and points of view and to do justice to new tendencies. The thesis which best accords with this ideal is as follows: *The living organism, when properly and adequately conceived, includes consciousness and is the sole source of that differential behavior which distinguishes it from less integrated bodies.* Or, to put the thesis from another angle, I shall maintain that the traditional mind-body problem resulted in large measure from false conceptions of both mind and body. There are delicate analyses to be made and false contrasts to be avoided. And for this necessary work an adequate epistemology is absolutely essential. Nevertheless, a sense of the correct lie of the land is fundamental. And I think that I reflect the contemporary drift when I assert that it is a good methodological principle not to assume a dualism unless there is no help for it. In the main, traditional statements sinned against this principle because they started with two substances, or realities. It will be remembered that Locke hesitatingly suggested that one substance might be enough.

My queries will, then, be as follows: Is not the organism

growing out of the data of observation, there is no mind-body problem.

Suggestions in Favor of Evolutionary Naturalism.—But while there is no mind-body problem in the traditional sense, when this method of approach is adopted, the nature and origin of this non-mechanical behavior becomes itself a subject of inquiry, all the more acute because specific. As long as the abstract, mechanical ideal of explanation, an explanation by reduction, ruled thought, the postulate maintained was that organic behavior could be reduced to a complex series of purely positional, or unintegrated, motions. A physical system was assumed to be nothing but the sum of its parts and their external relations. Organization counted for little. But to-day this postulate has been weakened by the growth of the biological sciences. It is, to say the least, just as possible that a system is more than an external sum of parts, that it is an organization in which the whole exerts a control over the parts, that the resultant is a function of the system.

But if these new tendencies are accepted, their implications must be worked out. The implication which I have constantly stressed is the forced admission of levels of causality in nature expressive of organization or creative synthesis. In other words, the empirical data force the thinker to construct categories corresponding to them, categories continuous with the old, and yet obviously striking a new note. Thus the mental level in nature is the level of intelligent behavior—of which, of course, there are degrees. Mental processes are brain-processes, and these control and express themselves in behavior.

Added knowledge about Organisms.—The behavior of individuals must be enlarged to include gesture, facial expression and language. Such data of observation are pe-

culiar because they are interpreted by the observer as symbols of inner states of consciousness to which he cannot otherwise penetrate. This act of interpretation is instinctive in its foundation and carefully cultivated because of its value. We should note, further, that there is an agreement between the overt behavior of the organism and the meanings of these symbols of expression and language. A says that he is going to the Campus, and I find that his body moves in that direction.

Overt behavior consists of the movement of the whole body or of a part in response to a stimulus or a situation. This second kind of behavior is not a physical adaptation like an animal's serial actions, but is social in its intention. It is essentially a communication. Let us see what it communicates. But first let us note that these words and gestures and facial expressions are symbols to us because we know, or think that we know, what they mean. Their meaning is, therefore, a part of the objective datum. A shake of the head means the feeling and idea we have when we say no.

The second series of behavior-data offers us a knowledge of the mental states of the individual who is communicating with us. Note that I say knowledge and not participation in. What we do is sympathetically to reproduce the mental state of our communicant, that is, we produce the meaning of the symbol. In the case of gesture and expression, this production is a trained reaction in which we sense an identity between our experience and that of the other person. We may call this a sufficient identity of *content*—with which alone we are concerned. In the case of words, we understand his statements and say that we know what he means or feels.

This added knowledge of the organism gives us an increased grip on mind. We said that for the physical sciences mind as a category covered the character of the

cerebral processes which control and find their expression in overt behavior. But now in these data of behavior which are symbols we gain knowledge of ideas and feelings which, combined as desires and plans, precede the behavior as apparent control of it. We are led into a deeper knowledge of mind. But a knowledge which raises perplexing questions.

The Epistemological Situation.—We must be careful to keep the epistemological situation clear if we are to thread our way through the coming difficulties. Let it be remembered, first of all, that all knowledge arises and exists only in the consciousness of individuals. The other point to remember is that there are at least two general kinds of knowledge: that which terminates upon data and is their interpretation by means of concepts, and that which uses interpreted data as material for knowledge about objects outside of the knowing consciousness. This latter kind of knowledge, which we have frequently called referred knowledge, divides into two sorts: (1) information about things of the type *founded on the characters of sense-data*, and (2) knowledge of the contents of other minds *through the mediation of symbols.*

In the case of another person, the knowledge gained in the various sciences is information about the organism of the sort mediated by the character and relations of sense-data intelligently handled and interpreted. This other person is an organism independent of the knowing individual; while the sense-data, interpreting concepts and propositions, are a part of the consciousness of the knower. We have seen that modern knowledge of the brain is beginning to lead to a realization of its structural and functional complexity. Organization is being recognized as an important feature of particular substances, and surely the organization of the brain is its paramount character.

Upon the organization of the brain which we call the instincts, there develops a still subtler and more plastic organization of habit and idea. Something of this sort is the information we possess of the functional texture of the brain.

Knowledge of the content of another mind is assertion of identity of content under the guidance of symbols. My feeling is enough like yours to be identified with it contentually. When you *look pleased,* I read into you vaguely my experience of pleasure. When you use certain words, I interpret you as having the same meanings in your mind that they suggest to me. How constant and unremitting our testing of this assertion of identity is! Ultimately, I presume, it rests upon correlation of behavior and meanings. If you say one thing and do another, you are either a liar or these symbols do not have the same meaning for us both.

We possess, accordingly, two kinds of knowledge about another's mind. How can these be harmonized? We admit that assertion of identity of content comes nearest to a literal participation in the reality known. Information-about, as critical realism insists, does not involve the presence of the physical reality in consciousness; and knowledge of content does not require the givenness in the knower's consciousness of the mental state known.

Another point. The situation in regard to another is essentially the same as that in regard to our own self, in all that concerns the mind-body problem. We know that another has a stream of consciousness; we experience our own stream of consciousness. We have information about his organism and essentially the same information about our own.

The Relation between Consciousness and Brain.—Mind has been an ambiguous term somehow felt to cover cere-

bral capacities, subjective operations and the changing content of consciousness; and as long as consciousness was thought of as alien to the organism *qua* physical thing, mental operations tended to be loosened from the body in sympathy with it. Not until consciousness is seen to be included in the brain will the term mind cease to be ambiguous and the age-old problem vanish in the more adequate conception of the living organism.

What, then, is the relation of consciousness to the brain? And how can we insert it into those cerebral processes which control intelligent behavior? Can mind as a category of physical science coalesce with mind as an appreciation of what takes place in consciousness—recollection, reasoning, valuing, planning—into a deeper knowledge about the content and operations of the brain?

There are, then, for the critical realist cortical processes which control and find expression in behavior; and there are conscious processes which apparently have a similar relation to behavior. We can only have information about the cortical processes, while we can either experience (in the case of ourselves) or know (in the case of others) conscious processes. How shall we conceive the relation between these two?

Empirical parallelism stresses what may be called a temporal correlation. The events in one series are temporally correlated with the events in the other series. Historically, this empirical correlation has passed through two stages and is just entering upon a third. The first stage may be called psychophysical correlation. This formulation was characteristic of the time when the brain was dogmatically conceived as a kinetic mechanism. The correlation could be only temporal because the two series did not have even a common form. What in consciousness could correspond with an atomic movement? The second stage may be designated psychophysiological correlation.

It stressed the temporal ordering of mental states with complex physiological processes. It was a psychochemical correlation in theory.

The third stage is just being entered upon. It is difficult to select a term descriptive of it. What is emphasized is the fact that the brain has functional "sets" and that a pulse of consciousness should be correlated with such a "set." What it stresses is the natural correlation of functional unities on both sides.

Thus temporal correlation is being supplemented by what may be called both formal and functional correspondence. There is an agreement of method between the conscious processes and the cerebral processes. Corresponding to association is the connection of neuronic groups; corresponding to the compresence of various sorts of sense-data is the cofunctioning of various subsystems; corresponding to meanings is some sort of process of summation. These correspondences have not been traced in detail because of the almost insurmountable difficulties on the technical side. Let our ignorance be admitted. Yet it holds even more fully for the older kinetic interpretation; and such knowledge as we possess indicates a far-reaching agreement in the principles characteristic of the two objects of study. The two domains harmonize in a way that suggests that they cannot be external to each other.

If these conclusions be admitted, the evident next step is to ask ourselves whether there is any sufficient reason why the flow of consciousness cannot arise literally in the brain as a part of its functioning. I have elsewhere sought to canvas the customary reasons for the exclusion of consciousness, and need here only repeat my conviction that they are founded upon misconceptions.[6] Critical realism undermines natural dualism with its vague assumption that we possess an intuition of the very stuff of the phys-

[6] Cf. *Critical Realism*, Ch. 9.

ical world that makes the presence of consciousness almost a logical contradiction. Of course, we cannot pass from our information about the physical world in any of its parts to an inference of any conscious content. But why should we expect such an impossible transition? It is an epistemological absurdity.

We have information about the brain, but no apprehension of the stuff of the brain, that is, no intuition of what physically *is*, no complete vision of its contents. Consciousness is a term for data which are open to inspection and analysis. Of it, alone, do we have a revelatory acquaintance. It follows that the *setting* of consciousness in the brain cannot be given. In other words, by the very nature of the case, we are precluded from witnessing the ontological linkage of consciousness with the being of the cerebral processes. Picture-thinking will not help us and is apt to lead us astray into patent absurdities. The situation is unique.

The Nature and Function of Consciousness.—Interactionism of the traditional type makes of consciousness a self-existent substance which externally acts upon the neural processes. Descartes's crude theory has given way to a mystical, because unintelligible, idea that consciousness affects the neurones at their synapses in the way of heightening or lowering resistance to the passage of a nervous current. But such an action in any plan must needs be very complicated. It would be like the playing of very many notes at the same time on the keyboard of a piano. It would seem much more likely that the cortical pattern in its entirety is a growth which is changed here and there under demand. It is more like the synthesis of modes of functioning, genetically developed, than like an action from outside.

The efficacy of consciousness must be relative to its

nature. There are those who can conceive of consciousness as having efficacy only if it is a form of energy. But energy is only a term for certain quantities in our knowledge about the physical world. I think that there is much plausibility in speaking about mental energy as a term descriptive of mental capacity. Thus those whose personality tends to dissociate are said to lack mental energy. But are we in these cases thinking about consciousness alone, or about it in its setting and conditions? I am persuaded that the latter is the case. Consciousness is inseparable from energy changes, but I do not believe that we are speaking critically when we say that consciousness is a form of energy.[7]

If consciousness is not a form of energy but just what it is given as, we must seek suggestions as to the character of its efficacy by a study of its conditions and its apparent function. Here we have an instance of real or ontological causality; we seem to be on the inside of nature as participants. Moreover, if our appreciation of the new tendencies in science is correct, consciousness is the correlate of cortical systems and not of particular cells as units. It has too readily been assumed that there was only question of efficacy of an impact type. But consciousness does not reveal the slightest basis for impact in its content. It is not a physical thing and cannot perform the operations of a physical thing.

What does experience suggest the probable function of consciousness to be? If this function accords with its nature, we should be on the track of the mode of efficacy of consciousness. To answer this question we might study the process of motor learning or reflect upon cases of action after deliberation. In the first type of case, it seems clear that some sort of ordered fusion is facilitated by conscious-

[7] It is better to speak of mental energy since energy is a category of physical science.

ness. It plays about growing points of integration. It seems to aid the growth of a complex system in which the parts touch one another off. We would appear to be to a slight extent on the inside of a process of synthesis. The organism on its nervous side functions as a whole in adjustmental reactions to its stimuli. Such reactions are by their very nature synthetic, and not physiological in a discrete sense. Percepts are peculiar expressions of the reaction and, by that very fact, cues which can represent it. I judge that the sensory content has the individuality of the system in which it has its roots. The one is as singular and specific as the other. But learning involves attention, and attention implies an organic interest and a larger system than the nervous basis of the sensory content. It is in and through the attention-system that conscious learning develops. And if this system has its conscious aspect or level—its focal rise into consciousness—it is not unlikely that its process is furthered thereby.

In action after deliberation, we have a conscious process of active selection in the light of ideas of consequences, all being guided by purpose and mood. And our decision certainly takes the form of a plan which appears to guide action and assuredly corresponds to our behavior. Hence our natural belief is that this conscious process counts for something; that, without it, intelligent behavior would be impossible. Are we justified in this belief? If consciousness is an internal complex of contents, sensory and affective, which are determinate reflections of the set of functional systems in the cortex under the play of intra-and-extra-organic stimuli, it may serve as a guidance or it may simply reveal the course of cortical processes. The one view is in sympathy with what interactionism has desired to defend—although blunderingly; the other view is analogous to epiphenomenalism.

In this dilemma, I accept the position that consciousness

is efficacious, that it has a function to perform. It seems to me to be a natural ingredient whose function is to aid in the solution of problems by the cues it affords. Literally, it assists the brain to meet new situations. The brain is coordinative, and consciousness is at once the expression and the instrument of that coordination. Planned action involves a changing system of great complexity in which there is an ordering of elements to one another. Consciousness does not link molecules, for that would be to materialize consciousness, to make a physical thing out of it. To put the suggestion bluntly, it is just because consciousness is not itself a physical substance, not a substance at all in fact, that it can be the focus of functional totality and guidance. Thus, out of an apparent dualism, we can achieve the thought of a more adequate monism which does not ignore differentiation. It is absurd to deny that consciousness is as we experience it. The fault with the traditional dualism was that it made consciousness into a substance coordinate with, and external to, physical substance. It is a unique variant expressive of the shifting unity of a highly organized system. It is, as it were, the eye of that system. Critical integrations must be intelligent if they are to meet the requirements of the organism. But we cannot understand their intelligence unless intelligence is actually at work within them as a part of their nature. In thinking, planning and desiring—in all those conscious processes which we call activities—we are on the inside of the brain and at its focal level of operation. Here objective and subjective activity are identical.

Advantages of this Theory.—If consciousness is at once the conditioned expression of the cortex and the instrument through which *operations* such as discrimination and anticipation are carried on, we can readily meet the traditional objections to the efficacy of consciousness.

In the first place, energy and its measurement applies to the whole cortical system. It is knowledge about the brain. Interactionism at least tends to make consciousness a substantial system external to the cortex and, for that reason, is confronted with the principles of science which assert that the physical world is a closed universe.

In the next place, our view takes the sensori-motor process as a unit and holds that the cortical integration of which consciousness is an element is always genetically continuous with a motor pattern of the brain. In other words, cortical integrations arise in one system with motor tracts. This means that ideas are from birth immersed in neural processes which have motor extensions. Ideas and motor tendencies are always on the same circuit. A dominant idea means a dominant cortical system, and such a system possesses its genetically developed roots. Behavior is a growth from instinctive tendencies to action; and it is within such instinctive functioning that conscious action appears. A purpose is, thus, a part of an active system which has its trained expression. Hence, in the brain itself, purposive idea and motor expression are only stages in a continuous neural process. Or, to speak even more exactly, the integration of the idea is at the same time the integration of its motor prolongation. But because only the idea is *given* to us we are prone to erect a dualism and to ask how the idea by itself—which we forget is an abstraction from its ontological setting—can *produce* what follows.

We are forced to conclude that the relation of consciousness to the brain is internal and unique. It is a relation which can be understood in some measure only when a correct knowledge about the brain's method of action is added to a proper conception of consciousness. Only then can we, as it were, see consciousness as immersed in, and continuous with, brain-systems in action. Had not M. Berg-

son been led astray by his sharp dualisms between space and time, spirit and matter, I feel certain that he would have reached such a view as ours. He suggests almost an identity of brain pattern and perception as a basis for the insertion of spirit into matter—from the outside. But for him the higher levels of consciousness cannot have this material matrix. It is impossible ultimately because duration is so different from space. But to us his argument is dialectical and not empirical. The physical world is not merely spatial. His theory of the categories and of the nature of the physical world makes an evolutionary naturalism impossible to him and causes those dualisms which characterize his cosmology. A correct analysis of the categories is thus seen to be fundamental.

Consciousness and Mind.—It has been our admitted purpose to get an adequate idea of mind which will harmonize the information gleaned by behaviorism with that accepted by introspective psychology. We should now be in a position to accomplish this feat.

If mind is a term for the nervous processes which find expression in the differential behavior of the organism, then objective psychology gains valid knowledge about the capacities, tendencies and general mode of operation of mind.

But if consciousness is at once the expression and guide of mind, changes in contents should indicate the activity of mind. For instance, an act of comparison is a process in which contents are correlated and brought synthetically together; and such an act is the function of some *interest*. We can find no creative agency in the contents of consciousness as such, but we do feel that they are present in and aid a genuine activity of the personality. They are elements in those selective and dynamic complexes which we call instincts and desires. The brain as mind is a more or

less integrated system of propensities and interests which respond to the situation in which the individual is placed. And such interests must not be thought of as physiological in any sense that excludes discriminative appreciation. They are neurological systems whose urgencies are inclusive of mental contents.

Consciousness must be connected psychophysically with neural processes of some reach. Attention, itself, can be understood only as a forward movement or passage in which the cerebral activity makes its path. What we must seek to do is to deepen our conception of the brain as at once activity and content. It is sensori-motor, ideo-motor; it is a stream of tendencies lit up by consciousness. The brain is synthetic because it is active. It is a more or less unitary process controlled by the neuronic system which is functionally uppermost. It is hard to describe what the reflective mind feels, that personality is like the deep heaving sea with its currents and counter-currents. It is the pressure of this complex, internal immensity that we call interest.

Our conclusion is that consciousness is a part of mind but by no means the whole of mind. It is too evanescent and passive, too little self-explanatory, to be so considered. It is relative to an organism and to that organism's activities.

If the arguments of this chapter stand firm, we have established the thesis that the living organism, when properly and adequately conceived, includes consciousness as a characteristic, internal feature of the functioning, neuronic system. It is a quality of a novel whole, and is as novel as the synthetic whole of which it is an expression. I have frequently called it a variant to bring out its existential correlation with a complex process. The field of experience of any one time is a *psychical structure* which corresponds to the activity of the organism. This correspond-

ence we have tried to explain in connection with perception as a neurally mediated activity.

When I conclude that any psychical fact is a quality of a nervous complex when functioning synthetically, I do not, of course, use quality in the sense of naive realism. The brain is not red when the psychical entity, red, arises in it. The use of psychical entities as the material of knowledge, while the object of perception is confused with the content of perception, gives rise to this misinterpretation of the psychical content. This problem involves the category of quality which we have discussed in an earlier chapter.

Psychical entities are not substances, but rather peculiar characteristics of novel wholes and inseparable from them. As soon as such psychical entities are thought of as self-sufficient things, dualism breaks out and they are extruded from the brain by our thought. As soon as they are conceived as more than contents, as more than they themselves reveal, as soon as they are given *by themselves* power to do things, they become to the deceived thinker non-physical and alien to physical reality. And it is very difficult for one to avoid these errors unless he is master of an adequate epistemology which has clearly seen the fallacy of naive realism.

Psychical entities are, then, contents which arise in the synthetic brain, and they are aids in the discrimination and correlation of objects. In terms of such contents acts of memory and anticipation clothe themselves, all this proceeding in the brain as a natural part of its adjustmental function. The brain has been underestimated in the past in behalf of a hypothetical reality postulated to perform functions rather dogmatically asserted to be impossible to a physical organ however delicate its structure. In contrast, we have argued that the brain is rightly conceived only when we supplement all the knowledge gained by the

physical sciences about it by all that the mental sciences can teach. It is literally the brain-mind, the home of consciousness and of mental capacities.

Panpsychism and Materialism are Extremes.—The evolutionary naturalist desires to combine the total information he can gather about the human organism. He knows himself to be an evolved substance of tremendous complexity whose material is that which he consumes each day in food and drink. He thinks, acts, adjusts himself to complex situations, ministers to his body, experiences fatigue, has sicknesses, etc. *That is the kind of a thing he is.* He is all of these cooperative functions at one and the same time. And yet the conscious self sits quite obviously in the watch-tower of the brain to guide the organism's behavior.

Materialism builds its outlook upon the conclusions of the physical sciences, and, naively taking this knowledge to be exhaustive of the organism, can find no room or function for consciousness. We have tried to correct this mistake by pointing out that in consciousness we are on the inside of the organism, or, to speak more correctly, are a literal part of the organism. We have also found that mental contents function in a guiding way in those operations of discrimination and correlation which the brain performs. Our conception of the brain has wonderfully enlarged as a consequence.

Panpsychism, on the other hand, starts from consciousness as something we are sure of and seeks to conceive it as capable of fitting the demands of the physical sciences. Much of past panpsychism was idealistic in its epistemological setting and so lightened its task. But for us panpsychism must make plausible the structure of the brain and the massive properties and relations of the physical world. Mental contents as I am aware of them or as I introspect them seem to me incapable of bearing this bur-

den. The contents of consciousness are correlative to neural processes which are not to be found at the inorganic level. They apparently come and go and are not directly conserved; there seems to be nothing more to them than is open to inspection. In short, they are not substantial and dynamic.

But I do not hold that mental entities must be objects of awareness in order to exist. Unconscious consciousness in the sense of psychical entities of which we are not aware appears to me to be no contradiction. Awareness involves a structure within a process of attention. The reason why the idea of unconscious consciousness has so often seemed absurd is the double use of the term consciousness which will be discussed elsewhere. But I do not see any adequate reason to believe that psychical entities of which we are aware differ markedly from those of which we are not aware, and *vice versa.*

To the panpsychist's objection that he is unable to understand the origin of the psychical from the non-psychical, the natural reply is that the physical world is not the non-psychical in any dialectical sense. If the psychical is novel, it follows that it could not have existed before. Consequently, we have on our hands only the general question of the origin of the novel. But is not the organism with its capacities novel? And why should not such a novel whole be accompanied by novel creations in the tensional adjustments involved? My own mind is not shocked by such a theory. It does not quail before a real, though a conditioned, beginning. Let him who feels otherwise show how a simple quality like red is the genetic product of something simpler. Frankly, it seems to me that there is novelty of an undeniable sort at every level of experience. Yet I hold that these novelties have their cerebro-mental setting and conditions.

To conclude: the epistemology of materialism is too

naive, and it founds its interpretation too exclusively upon the inorganic physical sciences. Panpsychism, on the other hand, builds too exclusively upon mental contents because these are the only entities literally given to the conscious self. It has generally been connected with idealism. But when it admits the validity of a critical realism, it has so many difficulties to face in making the psychical the equivalent of the physical world known by science that it ceases to be very plausible.

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MYSTICISM AND ART.

ONE of the most significant facts in the problem of modern life, and the most difficult to handle, is the many-sidedness of Western civilization. Every view of art, every commercial enterprise receives all the emphasis that the passion and individualism of genius can give. Each of the innumerable and brilliant facets of life acquires a prominence and makes a demand often compatible only with the oblivion of all the rest. In particular, it is a world where art most readily appears as a gilded or somber fantasy without reality and truth; and science no more than the separation of the mind from an external nature—a sense of mastery, without recognition of the alienation which is its price. But the moral nature of man appears to have suffered as deeply as any part of him, and become barren, alike because of overemphasis and because of isolation. Science, in spite of the enthusiasm and genius that have been poured into it, has not known the sphere where it could really serve a true social idealism; while minds of high ethical passion are too completely represented by Tolstoy who had to misinterpret his own experience and empty life of some of its greatest treasures before he could see it according to the light of his keen but narrow vision.

But many-sidedness need not be weakness. Is there any principle by which an epoch like ours can reap the fruit of its labor in science, philosophy and art and make them serve for wholeness and strength without losing the

value of their individuality and intensive development? It seems possible that there is, and this possibility we shall meantime discuss from the point of view of art.

It may seem strange that a generation esteeming itself enlightened through the achievement and the discipline of scientific thinking, and disillusioned through its disastrous encounter with an insulted and apparently revengeful universe, should seek refuge in mystical modes of thinking. But whether or not the mystical inclinations of to-day have borne any real fruit, it is just through the bitter experiences of knowledge and enlightenment and disillusionment that sometimes in the past men have transformed these self-same things and set them upon a higher plane. Our hope must be that they should do so again. For as on the plane of practical activity, they find the results of their science terribly disappointing, being deprived of the convenience and order of their economic systems at the very points where they had expected to gain most by them; so in the sphere of purely scientific or philosophic thinking there is a parallel dissatisfaction, a discovery that thought is deprived of the satisfaction that seems due to it—a profound and intimate contact with the world whose nature it had set out to learn, and whose problems it had determined to solve. This disappointment is, of course, old as the history of thinking humanity. But it is none the less acutely felt in an age where reflection is keen and critical as ever and pursued with more help from the accumulated results of past experience.

To start from the point of view of the thinking instinct itself, what are the remedies that thought proposes or seems inclined to adopt to free itself from the tyranny of its own criticism? In the first place, there is the instinct to forego thought altogether, to give up, to find refuge in some non-intellectual form of experience. And this movement gains the assent of thought itself. For it lies very deep in

human nature, and is not by any means symptomatic of shallowness or poverty of life, to declare that thinking is in vain, at once painful and fruitless—and that there are other things in life, love and pleasure, that if they be not better than thinking in so far as they seem to be as barren of ultimate fruit, have yet a kind of transitory profitableness in them, and being good while they last, have all the goodness that is anywhere available. Now there are numberless ways in which this reaction of thought from itself may take place, and the reflective judgments that are made about it are correspondingly innumerable.

But one of the most interesting modes of reaction of the mind against itself is that from thinking to the enjoyment of beauty in art. It is perhaps so interesting because of the conviction that things of beauty differ *toto coelo* from the process and results of thinking and are, to the extent of the difference, so far further along the road to lasting joy. Music, in particular, to so many severely scientific thinkers, seems to offer such a refuge from thought—from its demands and from its dispeace. Experience is, however, unable to maintain itself at this degree of tension. It has been found, for example, impossible in practice for the thinker altogether to stop thinking. And in those lapses back into thought, he is conscious of new discoveries. One of the most startling of these is that art even in a form so remote from reflection as music seems to contain, not indeed, thought, but something that is recognizable and thinkable only as a strange transformation and transfiguration of thought. But whatever insurmountable difficulties the mind may encounter in its attempt to give this mystery a name, it comes without hesitation to the conviction that it could not have come there without thought.

Sometimes the result of this discovery is to make the intellect start out afresh. It takes a new notion of itself. But it may equally well be that artistic experience of how-

ever high an order pays what appears to be the inevitable penalty attaching to any part of life whenever it is lived in isolation—dissatisfaction with itself. It may be questioned whether the genuine artist ever feels the parallel dissatisfaction in his work that the thinker does in his. And yet, consider how the very greatest artists seem to have been under some kind of necessity of passing out of their own proper sphere of art—like Michelangelo—and finding some other means of utterance, as in poetry. Michelangelo's case is indeed one of extraordinary significance. For here the real interest lies not in the mere fact of his versatility, but in the inner dialectic of his mind which leads him in some sense to renounce one medium of expression after another. Especially significant are those renunciations of graphic and plastic art which are the burden of some of the later sonnets, and of the most passionate of these. It is clear that in such, poetry scarcely appears to him under the aspect of art. In his prayer for "the hatred of lovely things," or in his complaint that "neither painting nor sculpture can any more give rest to the soul that turns to the Divine love," he does not know, or he forgets, that this renunciation of art bears both the form and the spirit of artistic beauty. Even Rodin, reviewing his own work in the light of his master's, forgets this too. "He was satisfied with art no longer. What he wanted was the infinite." But why then did he return to another form of finite artistic expression? Perhaps, however, the significance of Rodin's criticism lies in its being a movement of pure reflection, the sculptor's critical reflection about his own art, the final stage of a dialectic that begins in art and ends in thought. If this were so, it would follow that the mind would be driven back upon thinking for its full satisfaction even after the intensely emotional experience of beauty.

But, for all that, the radical defect of thought would

remain; and yet, because of its richer experience, the mind will think in a new way, and with new views of its own thinking-process and of the results of its thought. The paradox within which it will find itself moving will be something like this. Thought is forever inadequate to achieve the perfect comprehension and the deep and intimate penetration that it desires of the world which it sets out to know. The mind's very act of bringing precision into its aim shows it at once that this aim demands the clear recognition of the distinction between mind and the world which it knows and the need forever to maintain this distinction if thought is not to deny itself, render futile its own movement and stultify its own effort; while yet the very ground of its aim is the aspiration to rise above the distinction. The driving power of the mind is at variance with its method of procedure. The will to know is in contradiction with itself.

However we are to formulate the solution of this antinomy, there is actually an experience by which in some sense it is achieved. The point is reached where thought can no longer take refuge from its own dissatisfaction with itself by passing outside itself, as, for example, into art. It is now compelled not so much to relinquish itself as to transform itself while yet maintaining itself. This is the experience of mysticism.

The distinction, then, from the point of view of the thinking-process, between mysticism and such other forms of intuitive experience as we have typified, say, in music is quite clear. As opposed to the movement by which thought abandons itself and compels the mind to fly for refuge to the emotional and to the sensuous, mysticism is the demand which thought makes upon itself to reconcile its aim with its method, and heal the wound which the falling apart of the two is forever inflicting upon the mind.

In adopting this mode of statement I find myself at

issue with certain views of mysticism, such as Mr. Russell's in *Mysticism and Logic* which, though they give it the fullest sympathy, yet regard it as something external, and in a sense, alien to scientific reflection; and which must therefore be brought into harmony with it. But if mysticism comes to birth within the thinking-process itself, and is not something added to it from some other source, its contrast with science as in some way antagonistic is like the unreal contrast of genius to the patient and laborious work out of which its swift illumination arises, and which is, after all, the only soil that it can spring from. In all kinds of intellectual work, there is no doubt a certain strange transition from the merely laborious and painstaking to the brilliant and creative. It shows itself equally in science, art and philosophy—probably in far wider fields than these—but in these for certain. In philosophy it shows itself in the transition from scientific reflection to mysticism. But in thus placing mysticism in the sphere of genius, it does not mean that we are not free to recognize philosophical genius that is not mystical. For there are types of scientific and philosophical thinkers of the very highest order who have little or no mystical tendency. So that philosophy at its best would really provide us with two distinct, and possibly divergent, lines of development. On the other hand, starting from the idea that the mystical tendency is a true development of scientific or reflective thinking, we should hesitate to identify it with intuitive forms of experience like poetry and art, or at all events reject as untrue or insufficient an explanation which merely explained it through these as forms of intuition in general. Mystical thinking, in fact, stands out in strong contrast with art.

There is a difficulty of the same kind in a quite different order of experience from that of knowledge. It is very easy to accuse our own age—the epoch of the war—of

destitution in art and of indifference to beauty. It is another thing to gauge the truth of the charge. But however it may be, there is something in our present surroundings, in the economic and material conditions of modern life that makes us peculiarly alive to this difficulty—that while we most earnestly desire the presence of beauty, or the existence of arts that could profoundly interpret the character of the times through which we have been passing, there is no way by which beauty can directly be willed or by which art can immediately be produced, however great the desire. If we enlarge our point of view a little, and, instead of restricting it to what we suppose comes under the narrow categories of beauty or of art, consider the wider range of human experience that is represented in the old Greek view of τὸ καλόν, the nature of the paradox will become clearer. Τὸ καλόν, or what is noble, will include the moral life of man on its esthetic side. It is not merely pictures or poetry that can be beautiful in this sense, but character and action. Now it is plain at once that nobility of character, or even of particular actions, cannot be directly willed. The discipline that may produce it can, but not the aspect of beauty that belongs to it. Of this kind of beauty or nobility it is even necessary that it should not enter into consciousness at all, otherwise it defeats its own end. Or, if it ever does appear as an end of action, it must be completely lost to view in the action itself and in the motives to action. And yet the moral life would lose something, or would be wanting in an essential element, unless it could ultimately be contemplated in this way. It must always be possible in the end to view self-sacrifice as a fair or noble thing.

In this kind of experience, then, we find the same, or a parallel, difficulty of reconciling two essential moments without which the whole experience is not complete. There is the discipline which excludes consciousness of moral

intention to use them for that purpose may vitiate them or nullify them in the very aim.

Take, for example, sincerity, and all the possible emotions that this may involve in art, or that its absence may quench or distort. It has been often remarked in discussing the main problem of painting that what we are concerned to get is not truth but sincerity; that is to say, the painter is bound down not to a realistic representation of things, but simply not to feign what he does not really see, feel or believe. But clearly there is a difficulty here. You cannot be sincere unless there is something to be sincere about, or in other words, sincerity is not an emotion that in painting, or in any form of art, can be conjured into being where there is nothing that naturally calls it into play. And to try to get sincerity just for the sake of the artistic impression it is going to produce, seems to be an impossible task. Either you will get nothing at all, or something that is, in the very nature of the case, insincere.

From this point of view, then, Guyau and Ruskin are quite right. The essential of vital artistic expression seems to lie in an emotional tension, a tension that is produced by the love of something that is counted far better than the work of art itself. The true artist therefore is the man who can lay open to himself whole ranges of experience without conscious design to reap the fruit of that experience in beauty. And the further he can go in this disinterested absorption, admiration, reverence or love, the deeper will be the scope and vision of his artistic power. And when the time of expression does come, it comes with such fulness because of the concentration upon the objects of love, and not because the beauty of language or the harmony of sound or color is the aim or purpose of the artist. The more completely these can drop out of sight the higher the degree of success. They would, in fact, merely serve to dissipate his true esthetic attention. And

this is what we mean when we say that beauty cannot be directly willed.

One illustration of this principle is that the artist is sometimes so strangely one-sided—so splendidly one-sided, we might say, in some cases: where the moral aim, or the exposition of some intellectual conviction, or the expression of some narrow, but intense, patriotism is pursued at the expense, or in defiance, of everything else. English prose literature with its high degree of emotion and disregard of logic would be rich in examples of this kind. Milton is typical, but Newman is more remarkable, because the white heat of his emotion is so marvelously veiled in logical form. There is no more human document than the *Apology*, but it is not the humanity that is able "to see life steadily and see it whole." The view of religious truth which it sustains, while elaborated with as much sincerity as passion, would narrow down its evidence to such a vanishing point that none could see it save the writer himself.

But the great instance of the passionate conviction, of the unconscious, and therefore perfectly self-secure, one-sidedness which can sometimes be the soul of art, is that of Tolstoy. "In spite of his colossal artistic talent," Dostoyevsky wrote of him, "Tolstoy is one of those Russian minds which only see that which is right before their eyes, and thus press toward that point. They have not the power of turning their neck to the right or to the left to see what lies on one side; to do this, they would have to turn with their whole bodies. If they do turn, they will quite probably maintain the exact opposite of what they have been hitherto professing; for they are rigidly honest." Dostoyevsky would have been nearer the truth had he said that it was to these things, intensity of vision, together with the limitation of its field, narrowness of aim and rigid honesty that Tolstoy owed that colossal artistic talent of

his. He is the archetype of those masters of expression whose intensity of conviction serves them for lack of wholeness of vision. The degree of emotional tension within which alone we suppose art can come to birth would indeed, in such cases, have been impossible without this limitation; or at least, had the limitation been removed, that tension might have been greatly lessened, and they would have been artists of the second rank only. But in any case, the key to the nature of their art is conviction and sincerity, and the condition of its emotional fulness that their attention was directed anywhere rather than upon themselves or the esthetic character of their work. Or again, consider that craving for experience that is sometimes taken to be so essential to the artist. What yields the genuine result is not the intention to see life and reflect it in some expressive medium. It is rather the bitter fruit of experience, that unwilled by the artist, becomes the most perfect achievement of his work. The reality of penitence, for example, to what poignant music has it not given birth? And yet it is not a possible course of action for any man to go out in search of penitential utterance for its own sake.

But all artists are not like Tolstoy. There are some who like Sophocles are able "to see life steadily and see it whole," and there are others who, without losing their power or function as artists, know that they have this sincerity and wholeness of vision, and into whose work there enters the purpose to maintain it. They are not men of partisan mind, not patriots, not enthusiasts, not like Tolstoy or Milton "unable to discern where their own ambition modified their utterances of the moral law; or their own agony mingled with their anger at its violation." They are men to whom no human interest is alien, no human sympathy unknown, and to whom no kind of experience is inaccessible. Yet all that interest and all that

experience they have, or are capable of having, as artists. This is the remarkable thing. How shall we explain this impartiality of knowledge and scope of vision as belonging to the unconsciousness of art and having the power of unreflecting passion?

The most perfect lyrical utterance differs from the comprehensive vision of the dramatic poet just in this that its self-absorption admits of no awareness of the experience of other souls; whereas the self-abandonment that the dramatic poet must show in his absorption in any one character can never be without a recognition or awareness that other souls are moving and suffering elsewhere, or that there are other depths of experience besides the intuition that for the moment appears to be all-engrossing. The manifold of the interplay of character in a tragedy cannot, therefore, be a series of intuitions in which sympathy is given and then withdrawn and given again somewhere else and again canceled. Neither Othello nor Iago is conceived alone. And though there must be a wonderful absorption of the writer now in the one and now in the other, the emotional tension by which it comes about cannot be of the kind that belongs to the one-sidedness of art. Comprehensiveness of vision does not vanish in the intensity or depth of emotion at any one point. There seems, therefore, to be a kind of dialectic of art from the point where it begins in the expression of a single, splendid point of view up to the most comprehensive range of Sophocles or Shakespeare.

But there is still another step to be taken. Just as the intuition of one great character in a play, or of one great chorus, is able to pass outside the narrowness of a merely lyrical emotion, the poet may still be unconscious of the meaning of the whole play. And this unconsciousness may pass into the consciousness of doubt or wonder why he should so find himself a passive agent in the hands of a

power outside himself. This sense of perplexity or awe may of course fall outside the true artistic intuition and belong to the man who reflects and not to the artist who feels, becoming simply a matter of unperplexed inquiry. But it is not to be assumed that it does so always. It is possible that any work of art as a whole may contain within itself the recognition of its own nature; and there seems at least good reason for leaving it an open question whether a great artistic intuition may not also be a profound act of recognition of the nature and place of art in human life, or of beauty in the order of the spiritual world.

But as there are many critical thinkers who would challenge the possibility of a movement in philosophy through which the mind should be able to overcome the opposition between itself and its object, there would be, and with at least equal reason, the same challenge thrown out by artists, or by certain minds possessing a deep sensibility for art, of the meaning that could be attributed to art into which knowledge or will might enter, not merely as an external motive or setting, but as an inner quality expressible only through beauty. Such critics would remind us that though the same vehicle which is used for reflective thinking can also, in another way, be used in prose or verse as one of the most remarkable forms of beauty, there is nevertheless a unique possibility of deception in taking this kind of art—which happens to bear the form of reflection—as a means of elucidating the character of beauty in general as it is, or is thought to be, in common to all the arts. For it is so easy to attribute to depth of thought the power of verse that moves us so deeply; and therefore to attribute truth where we are only justified in asserting beauty.

But architecture or the forms of mountains and the colors of the sunset or pure music are beautiful without being reflective; and is it not likely that poetry must be

beautiful in the same way, that its beauty makes itself felt either in spite of its apparent depth of thought, which only gives the power of illusion, or because the reflective thinking which we find in it is a mere accident and quite irrelevant to its beauty? Whether this be so or not—and it is probably not so—we should at least be safe in taking such forms of art as pure music and such forms of beauty as mountain and sunrise to be our guide when we try to say what beauty is, or to find its place within the spiritual order and what it signifies with respect to that order.

If, using the language of the *Timaeus,* we were to regard natural beauty as the artistic workmanship of God, it would, as art, be perfect in this respect that it reveals nothing of the personality, nothing of the purpose or design, of the creator. It would be a piece of self-expression of such purely esthetic quality that the intellect can find no ground within which to make a single judgment about the reason or character of its beauty. Even in music we can trace both resemblances and developments, and in so doing are able to link it up with other parts of life. Of some music, as we hear its several voices lament to each other while they yet cry after one another as though in mockery, we say that none but Bach would have made the parts move against each other just like that; and there is some music that while we listen to it makes us see the hills of Salzburg as though they were present to the eye of sense. But of nature we cannot say that the view over the Lake of Geneva in a summer's dawn of the valley of the Rhone and of the Dent du Midi is more characteristic of the Deity than the starry sky of Königsberg on a winter night, or even that God liked the Alps better than the soft green hills of the Scottish Lowlands. The intellect is powerless to make a single step in tracing the character of the workmanship back to the workman. And yet, the pure intuition of nature is not the intuition it asserts itself to be unless

it goes beyond itself and implies a reference to something other than itself that we are able to think only under the aspect of what we know as judgment and reflection. It is not that it is to give us knowledge or vision of some transcendent reality; only that it implies the reality and truth of something that is more than itself. And it is this linking-up of world to world, of life to life, of one experience to another that recalls us to mysticism and makes us ask if it does not belong to apprehension of natural beauty, and therefore also to art.

But music comes closest to this character of natural beauty in its escape from the sense of personality, with its bonds of purpose and design. And music has this great power in its freedom from realism and externalization, that it does not represent a spiritual ideal or strive after the thing aspired to, but is actually part and parcel of the soul's life itself. As expressing itself in time, and only in time, it is coincident with the flow of that life, and not coincident only, it really is that life. For a piece of sculpture may express repose, and a picture may express unrest. But music if it expresses repose must actually be repose, or if it express the reverse, must actually be agitation. Now, what is characteristic of mental life as something that changes and flows onward in time, is that whenever it reaches a level such as that of expressing personality or of revealing itself as individuality, it also presents a unity that does not conflict with its character of being in time but that quite overcomes the diversity of time as it appears in ordinary experience, and its nature of destruction, effacement or absorption in itself. In personality, and perhaps in other forms of individuality, this unity is only an implicit one, or a unity that is only to be experienced as an abstraction for the intellect. But in personality as felt, or making itself felt, and especially in higher forms of individual experience that differ in degree or kind from what are dis-

tinctly personal, the unity ceases to be merely implicit, and becomes a perception or an intuition.

There is an effort of the mind, or goal of the will, to transform change and decay into permanence of life, and it is one of admitted value on all sides. It has been proposed as the ideal of knowledge in the eternal character of the idea; as the object of the moral consciousness in the realization of eternal life through temporal experience; and it cannot be without significance for what we know as beauty. What poetry and architecture, as the "strong conquerors of the forgetfulness of man," can vaguely symbolize, music can not only symbolize but acually be. Mozart, it will be remembered, said that when he composed music he heard it in his mind as a whole and all the parts of it, as it were, simultaneously. This may either be an exaggeration or the feeling of a musical mind of an unusually high order. But there are many who in listening to music that they love are quite simply and naturally aware of something like the simultaneous apprehension of temporally separate parts. For the reality and familiarity of the experience they are not dependent on Mozart's word of honor. There may be other kinds of soul-life that give as profound intuitions of this kind as music does. But there are none that give it in such clear and unmistakable terms. There is here, therefore, something more than a mere symbolization, something that actually expresses what is or may be an essential quality of time; that actually reveals its true nature. It may or may not be right to say that it manifests something eternal, and of which time is after all but the expression. But it is an experience that is certainly real, and that must have some meaning. Again, it is essential to observe that this sense of rising above the mere flow and sequence of time belongs to the intuition which is beauty in musical art, and not the reflection about it. And though as beauty of sound it seems to have the

CRITICISMS AND DISCUSSIONS.

ON THE THEORY OF PROBABILITIES.

A study of philosophical literature and periodicals of the last thirty years leads to the conclusion that the theory of probability has made little progress since the time of De Morgan and Jevons. Coupled with the lack of progress there has been an enormous development in the use of statistics, and there is other evidence of a growth of interest in the practical problems of probability. A large extension in the applications of a science, without a corresponding growth of interest in its principles, is sometimes dangerous. In the particular case of the theory of probability it is clear that a serious reexamination of its principles is urgently needed. A hint of a breeze in this direction is to be seen in *Mind*, October, 1918, where Prof. C. D. Broad restates the question of the relation of probability and induction. It is, I think, worth while to make a few general remarks in the lull before Professor Broad's lead is taken up and the whole question put on a more satisfactory basis.

Probability propositions are to be distinguished by the fact that they involve certain special notions. It is necessary first of all to discuss their form in order to see the nature of the entities to which the notions of probability can significantly be applied, and then to discuss what primitive ideas the system needs. It has been recognized[1] that in all estimates of probability there is an implicit or explicit reference to a state of knowledge relative to which the probability of some proposition is to be assessed. Probability in general has reference to two propositions; the fundamental notion is then the probability of one proposition being true assuming an-

[1] Cf. Jevons, *The Principles of Science*, p. 212; Broad, "The Relation between Probability and Induction," *Mind*, Oct., 1918.

other is true, or (as it may be more conveniently expressed) the probability of one proposition *on* another.

The propositions consist in a relation *less than, greater than* or *equal to* between probabilities, or in the evaluation of the probability of a certain proposition on a certain ground. It will be important to discuss the relation between these notions. We may, e. g., tentatively suggest that it may be necessary to take only one of these notions, *the probability of, more probable than, less probable than, as probable as,* as a primitive idea in the system. For we may use the relation *more probable than* as primitive, defining *less probable than* as its converse and *as probable as* as the negation of the sum of these relations. (This is only satisfactory if to say that one entity is more probable than another, if it is neither more nor less probable than the other entity, is to give a permissible interpretation of the notions involved.) Then the probability of an entity will be defined as the class of equally probable entities. The problems of the nature of entities to which these notions can significantly be applied, and of the relation between them, complete the first division of the theory.

A very superficial examination of the structure of our belief will convince us that there must be some probability propositions which are to be accepted because of their relation to other propositions involving the same notions, and some which are to be accepted independently of any such proposition. This division into primitive and derived probability propositions is essential. It must, however, be noted that primitive probability propositions may very well be logically derivative. The property which distinguishes them from other propositions of the group is that they are not derived from any other *probability* propositions. But it is a difficult matter to effect this division. The possibility of a theory of probability depends upon the fact that there is a certain measure of agreement as to which probability propositions are true and which are not. When, however, we try to discover which of these propositions are accepted derivatively and which are accepted primitively, we find that there is no great consensus of opinion. This science, like, for example, any serious science of ethics, must consist in part of making definite certain beliefs vaguely held by a number of people. It seems to be the case that people believe vaguely and with varying degrees of conviction large numbers of propositions not logically independent. A logical treatment of probability propositions which

is necessary if a system is to be established, will then include a discussion as to which are to be taken as primitive in the system and which are to be taken as derivative. The procedure will consist in discovering which various subsets of the propositions of probability are sufficient to imply the rest. It will then be necessary to choose one of these subsets; in our choice we shall pay due attention to the varying degrees of conviction with which the various propositions are believed. A careful consideration of the propositions to be taken as primitive in the theory of probability will throw light on the significance of the notions involved, and may perhaps lead to a definition of *more* or *less probable*. The existence of such a definition would then enable us to decide as to the truth of any other primitive probability propositions. It seems plausible to suppose that such a definition, however, will only come from a consideration of the generally accepted propositions of probability.

When the question of the primitive propositions has been discussed, an investigation into "probability inference" must be attempted. We must have, as in geometry, certain postulates as to how some probability estimates can be made to yield others. The general problem is to find the relation between the probability of p say on q in terms of the probabilities of a on b, c on d....To hold that probability inference is a possibility is to hold that certain probabilities determine certain other probabilities. The question as to what particular probabilities must be given in order that certain other probabilities may be determined will have to be discussed. There is, however, one general aspect of the problem upon which I wish to make a remark. Clearly we shall not expect to get a relation between the probabilities of a on b, c on d, e on f....and p on q, if there is no relation between a, b, c, d, e, f and p and q. This delimits at once the province it is possible for probability inference to cover. The fundamental logical relations between propositions are very few: out of them, all other logical relations of propositions can be manufactured. The relations are included in the following ones: (1) A proposition may be the contradictory of the other; (2) a proposition may be the sum of a pair of propositions; (3) a proposition may be the product of a pair of propositions; (4) a proposition may imply another proposition.[2] If, then, we are able to discover relations which it is plausible to suppose subsist

[2] It is not necessary to discuss here, whether the definition of implication in terms of the first two propositions is possible. (Cf. the definitions of Whitehead and Russell.)

between the probabilities of a on b, c on d, e on f....p on q when p and q stand in any of these fundamental logical relations to a, b, c, d, e, f.... careful manipulation will enable us to get relations between probabilities of p on q and the probabilities of a on b, c on d, ..., when p and q stand in any logical relation whatever to a, b, c, d.... The role of the postulates to be adopted is plain. We want relations between the probability of p on q, *not-p* on q, *p or r* on q, *p and r* on q; relations between the probability of p on q and r on q when p implies r; and further, relations between probabilities in which the state of knowledge relative to which they are to be assessed is varied in an analogous manner. This at once delimits the field: the fundamental principles giving the way in which probabilities can be combined will be correspondingly restricted. The form of these postulates should be noticed. One used by Jevons in *The Principles of Science* (p. 205), e. g., runs as follows. *The sum of the probabilities of two propositions is equal to the probability of the sum of the propositions together with the probability of the product of the propositions.* When we are concerned with getting further rules for the combination of probabilities we treat the postulates as propositions defining the way in which probabilities can be combined. As an example of the form of the results we may take: any predicate ϕ satisfying the propositions

$$\phi(x,h)+\phi(y,h)=\phi(x \text{ and } y,h)+\phi(x \text{ or } y,h);$$
$$\phi(x,h)\times\phi(y,x \text{ and } h)=\phi(x \text{ and } y,h)$$

also satisfies the proposition

$$\phi(x,h)+\phi(y,h)+\phi(z,h)-\phi(y \text{ and } z,h)-\phi(z \text{ and } x,h)-$$
$$\phi(x \text{ and } y,h)+\phi(x \text{ and } y \text{ and } z,h)=\phi(x \text{ or } y \text{ or } z,h).$$

The interesting point is that, any ϕ whatever satisfying the postulates satisfies the derived propositions. The process of obtaining the consequences of the postulates adopted is an exercise in pure logic and like the theory of the ancestral relation, which is vital for the analysis of mathematical induction or the theory of vector families which is important in the analysis of the notion of quantity, forms a chapter in the theory of modern logic. The process of deduction is then identical with the processes used in any branch of pure mathematics as, e. g., in projective geometry. The antithesis traditionally drawn between inductive inference and deductive inference is therefore to be abandoned, if a view of probability theory in accordance with modern logic is to be developed. As in all other

branches of knowledge in which there are some primitive and some derived propositions, the truth or falsehood of the derived propositions rests on that of the primitive propositions and on the truth of the postulates adopted as to the behavior of the concepts involved in the propositions, if we may assume that the purely logical problem of developing the consequences of the postulates has been correctly solved. If in any group among the derived propositions there are some which are exceedingly unplausible, the postulates and the primitive propositions adopted must be examined and modifications may then be made.

But it is important to keep the purely logical part of the subject separate from the inquiry into the truth of primitive probability propositions. The analogy with geometry is particularly suggestive at this point. Pure geometry consists in the investigation of the logical consequences of different systems of postulates, and in the analysis of these postulates. Applied geometry examines what propositions are true of the external world and takes over from pure geometry the logical consequences of the propositions. And it is in this connection that it is important to point out that the derivation of the consequences of the postulates adopted in probability theory can be put in the form: the property ϕ satisfies certain propositions, therefore it satisfies certain other propositions. We will take one example. It has been assumed in the traditional treatment of the subject that probabilities are quantitative. De Morgan, for example, in his *Essay on Probabilities* (p. 18), says in answer to objections as to the measurement of probability: "Again as we are most unquestionably justified in saying that it is more probable we shall draw one of the two *a* or *b*, than that we shall draw *a*, the argument must be directed against the method of measurement, not against the possibility of a measure: for wherever *more or less* are applicable terms, twice, thrice, etc., must also be conceived to be possible whether we can ascertain how to find them or not." We postulate that probabilities are quantitative in order to satisfy a vague unanalyzed feeling about them; this feeling would perhaps be as readily satisfied by the postulate that probabilities form a series (i. e., by the postulate that the relation *less probable than* is non-reflexive, connected and transitive) or possibly by a part of this postulate.[2]

This question of probabilities being quantitative is only one

[2] In particular it is possible that it may not be necessary to postulate connexity.

of the various problems as to which postulates most nearly represent our feelings about probabilities. In the light of modern logical analysis many assumptions as to the nature of probability no longer seem obviously necessary or satisfactory. It is a matter of great importance for the development of the theory of probability on a secure logical basis that these assumptions should be carefully analyzed into their constituent parts.

The object of this paper may then be summed up in the following way. Before embarking upon the general reconsideration of the interesting and important problems of probability, it is worth while to consider in general terms the various parts of the theory, with a view to laying down the lines which any satisfactory theory must follow. The form of the present inquiry is then sufficiently explained. Probability theory consists of a set of propositions grouped together by reason of the concepts involved in them. A satisfactory treatment of the subject should give a discussion of the nature of these notions, and in particular a discussion of the nature of the entities to which they can significantly be applied. It should also give in their most fundamental form postulates involving relations between various probabilities, the propositions implicated in these probabilities being connected by various fundamental logical relations. Further, the logical implications of these postulates should be developed, so that the relations between probabilities involving propositions connected by complicated logical relations may be formulated. The postulates and their logical consequences provide the principles of probability inference. In order that these laws of inference may be applied to the problems of science, it is further necessary to examine the primitive probability propositions which are to be assumed, and to work out the results logically entailed.

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THE FUNCTION OF GENERALIZATION.

I have a friend in one of the older sciences who has a reputation on both sides of the Atlantic for some splendid work he has done in one corner of his field. He is in many respects a broad-minded, tolerant man, especially when he is dealing with his friends or is concerned with matters outside of his province of technical investi-

gation. The other day he picked up from my desk one of three volumes of a ponderous work on the development of a certain social institution, remarking, "Such a book as that frightens me. It should never have been written." I was curious, but not altogether surprised. "Why not?" I asked; "is it not a good thing to have the knowledge so far uncovered synthesized for the general reader?" "Perhaps," he replied, "but it is bound to be full of errors; its writing should have been delayed at least one hundred years, if indeed it should ever have been undertaken. In the meantime the author might apply his energies much more to the service of science by taking some small section of his field or some one epoch and working that out as fully as the data will permit. That is the only way science will grow." I looked about the room full of books and remarked, "Perhaps you hold the same opinion about other attempts to generalize in sociology. What would you say of the works of Spencer, or of Lester F. Ward, or of this work in twelve volumes professing to give an account of the development of certain religious ceremonies and practices? Or would this one-volume work on social progress, or this on social control fare any better at your hands?" "All of them suffer from the same disease," he replied. "Think of trying to state a tenable theory of so wide a field as any one of these books attempts to cover. Without being familiar with your subject, I take it that you are only beginning to mine the ore of your data in any one of these fields. It is inconceivable that any one can write a general synthetic work in any of them which will be standard for a period of ten years, and I should suppose that there is no general agreement about the conclusions there set forth even now." "You are quite correct," I replied, "at least in regard to the tentativeness of the theories set forth. The authors themselves generally recognize this fact. Or, if they do not, the community of the sociologists do, and that is more important."

And then I tried another tack. This distinguished neighbor of mine submits, I have long suspected, to being called friend by me for other reasons than because I am a sociologist. My professional affiliations constitute a blot which he is willing to overlook in behalf of certain other considerations, one of which is that I can cheerfully take a defeat at golf and play again. Accordingly I suggested: "Possibly you would not approve of the methods of the social sciences in general, and of sociology in particular? Possibly you would not apply the sacred term 'science' to such lax disciplines as

we profess; possibly not even honor them with a place in our university curricula?" My learned friend smiled quizzically, almost as if he were on his favorite topic, and said, "I would not call sociology and the other fields of social investigation sciences, especially not in their general or theory aspects. They have not arrived at the maturity of sciences. Their methods are in process of formulation. They have yet a vast amount of concrete investigation to do in an appallingly large number of fields. When the concrete workers catch up with their generalizers and their generalizers pay heed to their investigators, the social subjects will become social sciences. In the meantime," he added smiling, "I suppose we must tolerate you—and admonish you. But, for heaven's sake, don't let your colleagues write such books as these."

All this was not entirely new to me. There are at least one hundred men in my university who feel much the same way about sociology and the social sciences. In every American university sociology hangs on by the skin of its teeth, as it were. Its teachers are required to handle classes of two or three times the average size of sections in the college, because funds are not appropriated by the budget-makers—consisting in the main of representatives of the older sciences—for the employment of enough instructors to meet the teaching requirements. And what is a little worse, we cannot secure funds for the carrying on of the investigations which our colleagues say we should make, because ours is not an exact science. We spend our days and nights running an adding machine (when we are fortunate enough to borrow one from another department) or in pounding out our own data upon the typewriter, while our friends have the clerical help and expert assistance they need. They merely "direct" their research. We must carry it on with the labor of our own hands and brains from the making of our schedules to the preparation of our manuscripts and then we may find that our petition for publication lies on file for months or even, on some occasions, for years and may finally be forgotten or denied altogether.

Something like this I said to my friend and he manifested the same polite interest which I have known him to express on other similar occasions. Really, he is not an administrator and I do not expect him to move heaven and earth—perhaps that is exaggerating the bulk of the opposition—for my beloved subject's cause. But to-day I was more interested in another matter, the direction which

our conversation had first taken and held to in the main. I knew that his views on the evils of overgeneralization were quite conventional and were shared by the general run of investigators everywhere. My friend has never written a general work, not even in a relatively special field, and he does not intend to do so: He has too much respect for his duty as a contributor to the fund of scientific knowledge. As much as I respect his achievement and the value of the highly specialized investigator, I did not think I agreed with his views on the function—or lack of function—of generalization. To make sure of his position, I asked him a question. I said, "Would you condemn the work of the generalizer in the older sciences equally as strongly as in the social sciences?" "Only in less degree," he replied; "the great need of science now and always is more concrete data, more special investigation."

"Are you not now speaking solely as a technician?" I replied; "it seems to me that unquestionably there are at least two great functions to be served by the scientist, and each is worth while, although largely for different reasons. You uphold one of these functions, that of the increasing of concrete scientific knowledge and the perfecting of methods of investigation to that end. I am wholly in sympathy with you and hope to see the day when my own subject can boast of men as distinguished in this line of service to science as those in any older field of investigation. But as a mere member of society—a citizen—I wonder if you would make the same argument as you have maintained. From this angle would you not find more use for the sociological generalizer?"

"I scarcely think so," he replied; "your writer on the history of the human family or the compiler and interpreter of all those questionable data on religious ceremonial, which I see over in the corner, misleads the public. Why cannot he be content to wait until some one or some one hundred real investigators have unearthed the facts?" "And leave the public, who are not scientists and have not the scientific method of criticism, to continue in error in the meantime?" I interposed, I fear somewhat intolerantly. "By no means," replied my friend, quickly; "the real investigators will publish their monographs and reports, and in these all the reliable data must be found anyway." "But the public does not read monographs and reports and never will," I contended; "it is only when some generalizer synthesizes these technical sources of knowledge into a connected and interpretative whole that the public will ever come to

understand the significance of the monographs of the special investigator and profit by their work. This, in my opinion, is one of the main functions of the generalizer—to interpret; to synthesize and harmonize the work of the special investigator so as to make it intelligible to and available for the general reader—the citizen, if you will. I admit your point, that in making a plausible whole out of incomplete parts the generalizer will often make mistakes and write things in his books which will not stand the test of time. But his is largely a social service, rather than a service within the narrow confines of his technical science, and it is such a great service to society that it is abundantly worth all the present error and the future correction which is necessary. The people have a right to know as much as there is to know at any particular time."

I had spoken with conviction. My friend was tolerant. He permitted himself merely to reply that he thought it better that the public should remain in ignorance of such technical questions for the time being rather than that they should be taught something which later they would have in the main to unlearn. For his part, he thought, we could go too far in muddling the brains of the average man with formulas and theories about things which did not particularly concern him anyway. Science is a matter primarily for the specialist, not for the public, and it should conform strictly to the canons of scientific procedure rather than to those of public policy, especially where public policy was little concerned.

"But," I contended, "you greatly mistake the public's attitude if you imagine they do not concern themselves with these matters. No error could be more profound than to suppose that the masses of people do not already have theories in regard to these very matters upon which these volumes which surround us are written. They are interested in everything under the sun. They have their explanation of the origin and development and functions of the family, of the meaning of ceremonial, of the sanctions of the State, the methods of fulfilling democracy, the relation of taxation to public welfare, and even of the origin of species and the biological value of war and the methods of achieving social progress even to the millennium—which unfortunately they, in common with some physicists, biologists, theosophists, Seventh-Day Adventists and the like, do not for a moment doubt will some day arrive as automatically as though it were predicated by an inherent law of nature. They do not lack for theories. The tragedy is that their theories

are so crude and uninformed by the light of scientific investigation. It is to throw this light of science upon the traditional theories of the sorts now held by the public that I would urge support of the generalizer. There is never any danger that a sincere and well-trained man in his subject, possessed of the confidence of his scientific fraternity, will fail to displace much more error in the minds of his readers by means of his general treatise than he will add to those minds. In fact, he is the chief clearing-house through which the average man must be rid of his unscientific traditional theories about a thousand and one things, and because he serves this social function he deserves the approval of society and even of the highly specialized scientific investigator."

My friend had listened to me patiently. He answered, after a moment's thought, "That may be true in the social sciences, where the average man is so intimately concerned personally with the subject-matter of those disciplines, and therefore has his erroneous or traditional theories already formulated; but I doubt if the argument applies with equal cogency to the older and better-developed sciences." "It does not apply equally, I admit," I replied, "because a long period of generalization by such men as Darwin, Huxley, Haeckel, Mendeleeff, Helmholtz, Herschel, Chamberlin, Loeb and scores of others more or less eminent has largely removed the traditional errors from the popular mind with respect to the fields of physics and chemistry and biology. The social sciences have not yet produced such a splendid exhibit of generalizers to accomplish this task for their fields. But we should, I think, welcome every generalizer of adequate training in his subject who will undertake this service to his less adequately trained fellow men. Even in the older sciences the early generalizers made many errors which have now to be corrected by further specific investigations, and as the fabric of their theories becomes rent with new knowledge until the mass of their work is discredited or supplanted, new generalizers arise to restate the knowledge since accumulated in those fields and to harmonize it with the old knowledge which remains undisputed. But for their day, the old generalizers led the masses of mankind to a new and better view of phenomena in their sciences just as do the new generalizers. No one should know better than the special investigator that ultimate truth is never attained in any one generation or by any one man, but that truth grows by small accretions and is relative to the age in which it appears. So does the general

intelligence of mankind grow and readjust itself to new worlds and times, under the guidance of the generalizers who digest the findings of the specialists and adjust them to the theories which have prevailed before."

My friend was thinking—about what he did not disclose. I am not certain that he had heard the last part of my monolog. Since he did not reply, I ventured upon a further remark: "But the social service is not the only one rendered by the generalizer, the writer of synthetic treatises. Perhaps an equally marked one is rendered to the advancement of science itself." "How do you make that out?" queried my caller, his interest returning, as much by way of shock as by conviction. "It serves scientific progress in two ways," I continued. "In the first place it does for the scientific investigator and the correlator something closely analogous to, although not identical with, what it does for the common man; it affords a point of departure for future work in the science. This is, of course, obvious enough in the case of the subsequent generalizers who construct their theories at least as much by way of critical reaction to the old treatises as by original generalization. But it is also true of the special investigator. There could be no consistent and organized progress in a branch of science except as the workers in it were able to proceed from some view-point or vision of the field as a whole. Otherwise experiment and statistical correlation would be largely random and whimsical, colored and skewed by personal interests of the investigator for the moment. Research can be planned and carried to successful completion only when the investigator, or some one who plans and directs his research, sees the larger synthetic problems of the science and its movement or development as a whole. And it matters little, I take it, whether the investigator agrees or disagrees with the general formulations of the science as expressed by the generalizer who serves as a point of departure. If the investigator finds himself in agreement he may be stimulated to work out in detailed quest of data some of the flashes of insight suggested by the generalizer. If he disagrees, his strong reaction against the conclusions of the theorist serves all the more to stimulate the researcher to the discovery of the data which will serve as the bases for correct and undisputed generalizations. Could," I asked, "modern biological science have made such rapid progress in the last fifty years if the controversial stimulus of the theoretical work of Darwin had been absent?" "No," said

my friend. "Has not the formulation of the Mendelian theory, following the investigations of Mendel and his successors, stimulated modern investigators into the field of heredity, both in behalf of the theory and in support of the theory of acquired characters, thus enriching our knowledge of this subject manifold?" "Undoubtedly," was the answer.

"A similar result was produced by the work of the sociologist Comte, and only a less marked influence was exercised by Spencer and Ward and others of their kind," I continued. "These men are no longer read with assiduity, even by scholars in the field. They have reached the stage of digest and analysis followed by interpretation and condensation for all but the specialists in the history of social theory and a few other general theorists. But the appearance of their works initiated new epochs in the study of social phenomena as well as closed old ones. They set new problems, by way of reaction from their conclusions, whether they desired it or not. And suppose," I went on, seeing that my guest was disposed to let me talk, "no generalizations had been made in physics since the days of Copernicus or Newton, but data from investigations and observations had piled up continuously, interpreted only by the lecturer and the teacher. Would not the task of sifting and putting in perspective these accumulated data now be so great as to be impossible? A careful investigator would have to spend the best years of his life sifting through this material, much as a searcher now goes through the files of the patent office looking for old models, before he would dare in conscience to begin a new investigation. The generalizer performs a valuable service to science merely by sifting through the accumulated material and discarding the rubbish while he organizes conveniently the acceptable achievement of the past.

"Nor must one neglect the public as a patron of scientific investigation. In these days of democracy, or near-democracy, no scheme for developing scientific investigation on a national scale and over a long period of time can fail to take account of the intelligent support of the voter. He will not read monographs. With the multitude of vocational and other interests which beset him, he will do well if he reads general works in a considerable number of sciences, either within college walls or later as he runs the gamut of life. He must have some understanding of the results of our work if he is to be expected to support it."

I had many other things in mind to say, but my friend was becoming restless. I should have liked to point out to him the value of the sciences for citizenship. I had in mind a particularly telling thrust, in revenge for his depreciation of the general sociologist, to be delivered by calling in question the utility of the six-year course of the modern medical school, in which he is interested, on the ground that it is very largely a process of instilling into the future physician the general conclusions or generalizations of the various medical sciences. I contented myself, however, with remarking in conclusion that, "Generalization is always valuable in all subjects. Like concrete specialized investigation, we cannot have too much of it, and we should encourage it heartily whenever any competent person is willing to undertake it. Unsatisfactory and incomplete as any one synthetic study must always be, it is a stepping-stone to something better, because it gives orientation and stimulation either to complete or to refute it. It is a point of departure."

My friend merely said: "I came by to see if you would like to try your hand at a game of golf." I took my clubs and went out with him, leaving the future of sociology and of all science except that of the nine holes, in abeyance.

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WHAT IS ESSENTIAL IN TEACHING PHILOSOPHY?

Practically every college in the country to-day demands that its students take a certain number of courses in philosophy. If you were to ask why these courses in philosophy are demanded from a student before he can graduate, the answers would undoubtedly be vague and hazy. The probability is that no two people would agree on just why it is essential that students take these courses in philosophy.

The prime reason for demanding that students spend a certain amount of time in the study of philosophy is due without doubt to tradition and custom. During the past decades a certain amount of philosophical culture was necessary, just as a certain amount of classical culture was necessary to any one who wished to be classified as a person of culture. Our curriculum traditions have undergone a change in respect to classical languages, and their importance has decreased and is decreasing with the passing time, due largely

to economic pressure, but philosophy still holds its time-honored, hoary place upon the list of requirements prescribed for students before they can graduate.

This philosophical mill through which the prospective bachelor of philosophy or of arts must pass has its humorous as well as its tragic side. There is a humor in seeing these students pigeonholed into certain courses in philosophy. Blindly they are thrust into a course in Greek, medieval, or modern philosophy; perhaps a course in Aristotle, in Kant, in Hegel, or in Dewey. It is entirely a grab-bag arrangement, and the course which is the snappiest, or which has the funniest professor, or which is located in the most convenient building or at the most convenient time is usually selected. The student may thus begin his philosophic studies with Hegel, Kant, Aristotle, Royce without having had any background whatsoever. Sometimes he has had a brief introductory course, which is usually a course of one quarter or one semester covering the entire field of philosophy.

This arrangement, of course, has disastrous results. The students get a certain amount of philosophic knowledge, but this knowledge is not at all connected or related to other facts of life, and is, consequently, as far as the student as an individual is concerned, absolutely valueless. This mass of knowledge, being unrelated and entirely independent of other facts of life, cannot be utilized and is, thus, soon forgotten.

Seldom, if ever, is the attempt made to give students consecutive courses in philosophy. Instructors in philosophy on the whole have not learned the value of knowledge in its setting. They have designed courses which consisted of dipping here and there into the stream of philosophic thought and taking sample courses in Kant, in Hegel, in Plato, in Aristotle with the greatest sangfroid. One student has taken this one, another has taken that one. The knowledge that they have obtained is not knowledge that can help them in their practical life, nor is it knowledge that can help them very much in cultural life, and the quizzical expressions on the faces of some of these students in philosophy is pitiable and is in itself a terrible indictment.

Just what reasons can philosophy give to justify its place on the curriculum of required subjects of the undergraduate? Is the knowledge that one gains in studying various systems of philosophy a knowledge that is useful and essential in practical life? If that

were all that philosophy could give to justify her place, she would indeed deserve to be thrown out at once, tooth and claw. Philosophy is a study that does not put content into the mind, but it develops the individual view-point; it teaches the individual to interpret and evaluate life in a philosophical manner. It furnishes no new materials from which to build new structures of knowledge, but it digs around in the dump hills and ash heaps of commonplaces and finds there rare and costly ornaments and materials which the individual never knew of and which he can use. Philosophy can be compared with a piece of agricultural machinery: the machine does not add anything to the soil, but by using the machine the soil can be better cultivated in a shorter space of time and the result is a vastly increased profit for the owner. Philosophy, then, is a view-point and a method, rather than a certain branch of knowledge, which must be learned and digested into activities of life.

To improve this machinery of the mind, to give this philosophical outlook upon life should be the aim of philosophy. With this aim firmly established it becomes one of the most important and vital subjects that the undergraduate must take. It establishes then for itself a secure, firm basis, and "the gates of hell shall not prevail against it." Its value becomes stupendous, for it furnishes the foundation for all the knowledge that the student gathers; it becomes, in other words, the corner-stone for his education. Philosophy will cease to be underestimated as it is now so ofttimes, and will be able to take its place among the subjects that are essential and important.

But just how do we go about this process of improving the machinery of ideas? What are the essential things that must be taken into consideration? The key-word to the whole process is "interest." Material must be selected and handled in such a way that the student's interest will be aroused, his curiosity must be stimulated, and then by proper handling of these materials an abiding interest in philosophy and a philosophical attitude toward life can be created.

Instead of chopping philosophy up, as is the custom at the present time, into logic, ethics, metaphysics and esthetics, we will take the whole field of philosophy as it lies stretched out before us with its beginnings in the distant past, and stake out a clear-cut path through the wilderness. The important philosophers of the ages, those that have contributed heavily to the philosophic thought

of the world, will be studied as a unit. Each philosopher that is dealt with will de discussed from the standpoint of his ethics, his metaphysics, his logic, etc. Instead of giving separate courses in ethics, in logic, in metaphysics, these philosophers will be studied in consecutive order, and thus we shall in a gradual way unfold to the student the philosophical thought of the ages. The instructor need not worry then about holding the interest of his class, for he shall have definitely settled that problem. Philosophy is the most interesting study when handled in a scientific manner. A general course like this in philosophy should run throughout an entire academic year. I know some will shrug their shoulders, if they do nothing worse, at this profanity. "How could it be possible," they will exclaim, "to give a student more than just a bare inkling of the subject in this space of time?" To those I would say: "Examine your teaching methods. If you can't give a student something more than just a superficial knowledge of your subject after you teach him an entire year, there is something wrong with your methods or with you." The philosophy of the present and of the past is not found in great verbosity. In order to give knowledge it is not necessary to use great volumes of words or to wax eloquent in language. Of course, organization is necessary, and it is taken for granted that you know how to present your materials. I know that when I teach a class in general philosophy for an entire year, I shall perhaps not have been able to give them an all-comprehensive knowledge of the subject, but I am assured that they will at least have a fairly thorough knowledge of that subject.

By combining logic, ethics, metaphysics, philosophy of religion all in one a great deal of valuable time will have been saved: moreover, these fields are more or less interrelated, and when we tear them apart and abstract them from each other, as we are doing at the present time, we are creating an artificial division within the mind of the student which is entirely unjustified, and, in consequence, we rob these subjects of a large part of their value. For instance, when you study Plato, why not study his metaphysics, his logic, his ethics, his political philosophy all at once instead of taking each one separate and labeling them under different courses? As I say, you save time and do away with confusion, for if you study Plato in various courses, such as ethics, logic, political philosophy, etc., the odds are that no one student will get all the courses, and the confusion is complete. How long, oh Lord, how long, might

well be our cry, must education be dished out in this single, pigeonholed style? Let us strike out into the wide sea: let us say farewell to the hampering traditions of the past and let us map out for ourselves a course which shall be in accordance with the light of science.

What should I stress in philosophy to the average student who is not making a special study in the field of philosophy? This is perhaps the question that is heard most frequently. It is an important question, and the way in which this question is answered is what determines whether or no a course in philosophy is a success. To the average student, it seems to me, the ethical and social side of philosophy should be stressed. The ethical side of philosophy, not so much the historical side, but the live ethical questions of the day can be made very interesting, and here the instructor has untold possibilities in developing the thought of his students. He can take live ethical problems and criticize them and pass judgment upon them in the light of the ethical concepts of the past. Of course, some historical background and some psychological background will have to be presented, but by confining himself mostly to the philosophical problems involved he will have the most success. In the same way he can treat the social side of philosophy. This would include politics, religion, etc. Here he would have a field which is just as interesting to-day as it was two thousand years ago. By emphasizing these sides of philosophy the instructor could instil into his class this philosophical attitude which spells rationality and science.

The personal equation cannot be overlooked in the teaching of philosophy. Too often men are chosen for other reasons than ability to fill our chairs of philosophy. This, of course, is entirely unjustifiable. It is customary in many of our universities of to-day to judge a man's teaching ability by a book or some books that he has written. As a matter of fact, this is no gauge for his ability as an instructor. Many men that have a fine literary style are, nevertheless, complete failures as instructors. The inevitable result of this we can see. Every man that is holding down a chair of philosophy, or that is in any way connected with a department of philosophy, is anxiously attempting or has attempted or has succeeded in writing one or more books. I would in no wise belittle these efforts, for they are in themselves very creditable, but is such a course of procedure fair to the students who are in their

already in existence. In many cases, activities have been preceded by mental processes characterized by a high degree of emotional tension....In cases of this type....there may arise the tendency or, indeed, the necessity for it to drain off or express itself in overt behavior....Thus, instead of merely kicking a tree or stone in impotent rage at his enemy, which is an immediate dramatized expression of what the primitive man would like to do to him, he proceeds to elaborate and amplify these haphazard acts—he constructs an image and then performs a more or less extensive operation upon it."

It is plain that Dr. Schleiter goes here beyond the observable facts—he is delving into the psychology of the subconscious (cf. especially pp. 161ff). Viewed from another angle, he casts light upon the gropings of the human mind at a stage far more primitive than at present found anywhere on the face of the globe.

Such implications are, of course, apt to vitiate the complete abandonment of the developmental theory of culture origin as found on page 42 (see quotation above), and Dr. Schleiter was probably aware of the fact. At any rate, he cautions us, in the very last paragraph of his book, against drawing just those conclusions which a rigorous interpretation of his views would lead to. "We do not mean," he says, "to attack, indiscriminately and at large, the processes of generalization and abstraction and to contend that the proper study of all cultural phenomena consists in the return to concrete particularity in such a manner as to involve nothing more than descriptive characterizations and a gossipy interest which finds emotional consolation in mere *disjecta membra*...." Instead, he merely wants to counsel "much more critical caution than is customary" in the universalizing of particular aspects of primitive civilization. This advice will have to be heeded, for nobody who has a stake in the field can afford to ignore Dr. Schleiter's book, whether he may like it or not. X. B. N.

THE IDEA OF IMMORTALITY: ITS DEVELOPMENT AND VALUE. (The Baird Lecture, 1917.) By *George Galloway, D. Phil., D.D.* Edinburgh: T. & T. Clark, 1919. Pp. viii, 234. Price, 9s. net.

Professor Galloway gives a rapid summary of what Herbert Spencer calls the insoluble problem—human immortality. The book is a small one, but ably summarizes the main and familiar lines of argument. Science can supply us neither with valid grounds for rejecting nor sufficient reasons for accepting the doctrine of human immortality. Dr. Galloway's conclusion as to the evidence provided by "psychical research" is *non liquet*. Metaphysics can give no proof of immortality, though Dr. MacTaggart argues that "the Absolute has eternally differentiated itself in finite centers, which neither come into being nor pass away. The human ego is one of these finite differentiations and therefore is eternal and immortal." The trouble is that Dr. MacTaggart does not prove the Absolute must be differentiated in this manner, and if this *were* so, that the human soul *is* one of these differentiations (p. 146). The metaphysicians following Kant emphasize the desire for immortality as its own vindication, and this ethical argument has, with Dr. Galloway, great weight. There remain what are called religious evidences, in especial the Resurrection of Christ. Dr. Galloway, like many modern theologians, holds that the Resurrection, far from proving immortality, requires faith in that doctrine to make it credible. "The

skeptic turns from the evidence unconvinced; the Christian finds it confirms his faith that death is the gateway of life." In conclusion Dr. Galloway sees in immortality, with Mr. Fiske, "a supreme act of faith in the reasonableness of God's work." M. J.

LIFE AFTER DEATH. PROBLEMS OF THE FUTURE LIFE AND ITS NATURE. By *James H. Hyslop, Ph. D., M. D.* London: Kegan Paul, Trench, Trübner & Co., 1919. Pp. xii, 346. Price, 9s. net.

This book is, in part, historical, and historically sound, the first three chapters concerning themselves with the record of primitive conceptions of a future life, and the pre-Christian ideas of civilized nations. After this point, Dr. Hyslop assumes the survival of the spirit of man after bodily death, referring the reader to the "plentiful and voluminous" material in the publications of the various Societies of Psychical Research as evidence, and then attacks the further problems, such as the nature of this existence after death (Chapter IV), the process of communication between this world and discarnate spirits. There is a chapter on the dissociation or disintegration of personality, which is a familiar feature of psychic research; and skeptics may find cause for skepticism in an account of the obsession of Doris by the spirit of Count Cagliostro, who was finally induced to go into a monastery or hospital in charge of Anselm, the eleventh-century Archbishop of Canterbury (p. 303). "Good evidence" of a spirit's personal identity seems somewhat too readily accepted by the author. Dr. Hyslop's attitude throughout is uncompromising: "I regard," he says, "the existence of discarnate spirits as scientifically proved, and I no longer refer to the skeptic as having any right to speak on the subject. Any man who does not accept the existence of discarnate spirits and the proof of it is either ignorant or a moral coward"—an attitude very different from that of the late Lord Rayleigh, when investigating similar phenomena. J.

PAGAN AND CHRISTIAN CREEDS: THEIR ORIGIN AND MEANING. By *Edward Carpenter.* London: G. Allen & Unwin, Ltd., 1920. Pp. 318. Price, 10s. 6d. net.

Mr. Carpenter's thesis is that the Christian religion is not the *merle blanche* among thrushes, though (in this country at any rate) it has managed to persuade the general public of its divine uniqueness to such a degree that few people, even nowadays, realize that it has sprung from just the same root of paganism, and that the evolution of rites and ceremonies has been the same all over the world. "There has been, in fact, a world religion, though with various phrases and branches."

He accounts for the unity of this phenomenon by linking it up with the evolution of human consciousness. It proceeds from and accompanies "the three great stages of the unfolding of consciousness, firstly, that of simple or animal consciousness, secondly, that of *self*-consciousness, and thirdly, that of a third stage" (p. 16) which has not been effectively named: perhaps cosmic consciousness. But the speculations as to this future stage of consciousness are mystical, and on the lines of "wouldn't-it-be-nice-if": "Why should there not arise a sense of non-differentiation in the future, similar but more extended, more intelligent [than the early stage]. *Certainly, this will arrive,* in its own appointed time." J.

THE ORIGIN OF THE DOCTRINE OF THE TRINITY. By *Rendel Harris*. Manchester: The University Press, 1919. Pp. 41. Price, 2s. 6d. net.

The author gives in this lecture or pamphlet his reasons for supposing, firstly, the existence of a lost book of the first age of Christianity, and secondly, a lost Christian doctrine of the first century, according to which Jesus was defined as the Sophia or Wisdom of God. "What we propose to do," he tells us, "is to show that by the discovery of two fresh facts the whole matter of the evolution of the Trinity is put in a fresh light." This would certainly be the case if the two contentions were facts. In the first of these contentions, Dr. Harris sketches his arguments in a summary and popular manner. He has dealt with this hypothesis elsewhere; but it is unfortunate that he refers to the existence of the Book of Testimonies, which sets out with the idea that Christ was the Wisdom, not the Messiah of God, as a "fact." Against this is to be set the emphasis of St. Paul and the Synoptic Gospels upon Christ as the Messiah.

C. B.

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